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Medical Essays AND OBSERVATIONS.

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MDCCXXXVII.





CONTENTS.

Art.	Pag.
I. <i>THE Meteorological Register,</i>	1
II. <i>An Account of the Diseases that were most frequent last Year in Edinburgh,</i>	126
III. <i>An Extract from the publick Register of Burials in Edinburgh,</i>	31
IV. <i>An Account of the Effects of the Conessi Bark, by ———</i>	32
V. <i>A Gangrene stopped by the Cortex Peruviana, by Mr. Samuel Goolden Surgeon at Bridgnorth in Shropshire,</i>	35
VI. <i>A Mortification cured by the Peruvian Bark, by Mr. John Paisley Surgeon in Glasgow,</i>	43
VII. <i>Remarks on chalybeat Waters, by Alex^r. Monro Professor of Anatomy in the University of Edinburgh, and F. R. S.</i>	47
VIII. <i>An Enquiry into the mineral Principles of Montrose Water, by Alexander Thomson M. D. Physician at Montrose,</i>	60
IX. <i>The medical Qualities of Montrose Well, with some Instances thereof, by the same,</i>	96
a 2	X. <i>An</i>

Art.	Pag.
X. <i>An Essay on the Method of preparing and preserving the Parts of animal Bodies for anatomical Uses, by Alexander Monro, P. A.</i>	107
XI. <i>Thoughts concerning the Production of animal Heat, and the Divarications of the vascular System, by Dr. George Martin Physician at St. Andrews,</i>	133
XII. <i>An Essay concerning the Motions of our Eyes, by William Porterfield, M. D. Fellow of the College of Physicians at Edinburgh,</i>	160
XIII. <i>Supplement to Art. ix. of Vol. I. and to Art. ix. and xiii. of Vol. II. by Alexander Monro, P. A.</i>	263
XIV. <i>An Account of a Child born with the Urinary and genital Organs preternaturally formed, by Mr. James Mowat Surgeon at Langholm,</i>	278
XV. <i>An Essay on the Diseases of the lacrymal Canals, by Alexander Monro, P. A.</i>	280
XVI. <i>A Tumor of the Nose unsuccessfully extirpated by ————</i>	301
XVII. <i>An Account of a Procidentia Uteri, by Alexander Monro, P. A.</i>	305
XVIII. <i>The Description of a Pessary, invented by Dr. Thomas Simson, Professor of Medicine in the University of St. Andrews,</i>	313
XIX. <i>An Account of the Sides of the Os uteri grown together, by the same,</i>	317
XX. <i>The Description of a Forceps for extracting Children by the Head, by Mr. Alexan-</i>	den

C O N T E N T S.

Art.	Pag.
der Butter <i>Chirurg</i> in Edinburgh,	322
XXI. <i>An Account of a malignant Lues Venerea communicated by Suction; by Edward Barry, M. D. F. R. S. Physician at Cork,</i>	325
XXII. <i>A remarkable Hydrocephalum, by Mr. James Mowat, Surgeon at Langholm</i>	334
XXIII. <i>A Hydrocephalum, with remarkable Symptoms, by Mr. John Paisley Surgeon at Glasgow,</i>	335
XXIV. <i>An uncommon Angina, by Alexander Monro, P. A.</i>	342
XXV. <i>An Asthma with uncommon Symptoms, by the same,</i>	349
XXVI. <i>A large Steatom passing with the Oesophagus, from the Thorax into the Abdomen, by Mr. James Jamieson, Surgeon in Kello,</i>	354
XXVII. <i>Of the Service of a warm Bath in a bilious Colick, by Robert Porter, M. D. Member of the College of Physicians London,</i>	358
XXVIII. <i>The Water of a Dropsy evacuated at the Navel, by Dr. Francis Pringle, late President of the College of Physicians at Edinburgh,</i>	378
XXIX. <i>The Menstrua regularly evacuated at an Ulcer of the Ankle, by Mr. James Calder jun. Surgeon in Glasgow,</i>	381
XXX. <i>An Account of Medical Discoveries, Improvements and Books published in the Year 1732, and omitted in the second Volume,</i>	382
	XXXI.

Art.	Pag.
XXXI. <i>An Account of the most remarkable Improvements and Discoveries in Physick, made or proposed since the Beginning of the Year 1733,</i>	386
XXXII. <i>A List of Books published since the Beginning of 1733,</i>	414
XXXIII. <i>Books proposed, and other Medical News,</i>	420

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Medical



Medical Essays

A N D

OBSERVATIONS.

ARTICLE I.

The Meteorological Register.



THE Instruments described in *Article II.* of our *first* Volume were employed in making the following Observations.

A

JUNE.

JUNE 1733.

D.	Hour.	Baro.	Ther.	Hyg.	Wind.		Weather.	Rain.
		In. D.	In. D.	I. D.	Dir.	For.		
1	9 a. m.	29	9 12	7 0	9	N.	2	Fair
	8 p. m.	29	8 13	3 0	9	W.	3	fair
2	9 a. m.	29	8 13	7 1	1	W. b. N.	2	fair
	8 p. m.	29	9 14	3 1	5	W. b. N.	1	fair
3	9 a. m.	30	0 12	6 1	3	E.	1	cloudy
	7 p. m.	30	0 13	4 1	1	E.	1	cloudy
4	9 a. m.	30	0 13	6 1	1	S. E.	1	cloudy
	8 p. m.	29	9 13	0 1	5	E.	0	cloudy
5	8 a. m.	29	8 13	3 1	8	E.	2	cloudy
	7 p. m.	29	8 12	6 1	5	E.	2	cloudy
6	9 a. m.	29	8 13	4 1	5	E.	1	fair
	7 p. m.	29	8 12	8 1	5	E.	2	fair
7	9 a. m.	29	8 13	4 1	5	E.	1	fair
	7 p. m.	29	8 15	0 1	2	E.	1	cloudy
8	9 a. m.	29	7 12	9 1	5	E.	2	cloudy
	6 p. m.	29	8 13	0 1	3	E.	2	fair
9	9 a. m.	29	7 13	3 1	2	E.	1	fair
	7 p. m.	29	6 13	2 1	4	S. E.	1	cloudy
10	9 a. m.	29	8 12	7 1	2	N. E.	1	fair
	7 p. m.	29	9 12	7 1	2	E.	2	cloudy
11	9 a. m.	29	9 13	8 1	4	E.	1	fair
	7 p. m.	29	9 13	7 1	3	E.	0	cloudy
12	9 a. m.	29	9 14	8 1	5	S. E.	0	cloudy
	8 p. m.	29	7 13	5 1	8	E.	2	Rain
13	9 a. m.	29	7 13	4 2	8	N.	0	Rain
	5 p. m.	29	7 14	5 2	1	N.	1	cloudy
14	9 a. m.	29	7 14	4 2	1	N.	1	fair
	8 p. m.	29	7 15	3 1	4	W.	1	fair
15	9 a. m.	29	8 15	6 1	4	S. W.	1	cloudy
	8 p. m.	29	8 15	5 1	1	S. W.	1	cloudy
16	9 a. m.	29	7 16	0 1	5	S.	0	cloudy
	8 p. m.	29	6 14	3 1	4	S. W.	2	fair

J V N E 1733.

D.	Hour.	Bar. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain.
							0,960
17	9 a. m.	29 6	15 6	1 2	S.	2 Cloudy	0,085
	8 p. m.	29 5	14 3	1 4	S. W.	2 cloudy	
18	9 a. m.	29 5	14 6	1 6	W.	2 cloudy	0,055
	8 p. m.	29 3	13 5	1 4	W.	2 cloudy	
19	9 a. m.	29 2	14 1	1 4	W.	2 fair	0,035
	9 p. m.	29 1	13 5	1 5	S. W.	1 Rain	
20	9 a. m.	28 9	14 1	1 8	S. E.	1 Rain	0,316
	5 p. m.	28 9	14 5	1 5	W.	2 fair	
21	9 a. m.	29 3	13 9	1 7	W.	3 fair	0,173
	5 p. m.	29 6	13 7	1 3	W.	3 fair	
22	9 a. m.	29 8	14 2	1 4	S. W.	1 fair	0,145
	5 p. m.	29 9	14 6	1 3	S. W.	1 cloudy	
23	9 a. m.	29 9	15 0	1 5	W.	2 cloudy	
	8 p. m.	29 9	15 2	1 2	W.	0 fair	
24	9 a. m.	29 9	14 9	1 3	E.	1 fair	
	8 p. m.	29 9	15 4	1 5	E.	0 fair	
25	9 a. m.	29 8	16 0	1 4	S. W.	0 cloudy	0,084
	9 p. m.	29 9	16 0	1 3	W.	0 fair	
26	9 a. m.	29 9	15 3	1 7	E.	0 Fog	0,100
	7 p. m.	29 9	16 1	1 7	E.	0 fair	
27	9 a. m.	29 9	15 2	1 8	E.	1 Fog	
	8 p. m.	29 8	14 1	2 5	E.	2 Rain	
28	9 a. m.	29 8	16 0	1 6	S. W.	2 cloudy	0,150
	7 p. m.	29 8	15 0	1 2	S. W.	1 cloudy	
29	9 a. m.	29 8	14 8	1 4	S. W.	2 fair	
	8 p. m.	29 8	14 1	1 7	S. W.	2 cloudy	
30	9 a. m.	29 9	14 7	1 6	S. W.	2 fair	0,035
	8 p. m.	29 9	14 7	1 6	S. W.	2 fair	
H. at a med.		29 8	14 2	1 3	Total Depth		2,138
Gr. Height		30 0	16 1	2 8			
L. Height		28 9	12 6	0 9			

JULY 1733.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29	9 15	5 1	4 N. W.	1 Fair	
	8 p. m.	29	9 15	0 1	1 W.	1 fair	
2	9 a. m.	29	9 15	3 1	5 E.	1 fair	
	8 p. m.	29	9 15	8 1	3 E.	1 fair	
3	9 a. m.	29	9 14	5 1	4 E.	1 fair	
	7 p. m.	30	0 15	0 1	5 E.	1 fair	
4	9 a. m.	30	1 14	7 1	9 E.	1 fair	
	5 p. m.	30	0 15	1 1	7 E.	1 fair	
5	9 a. m.	29	9 15	7 1	7 S. E.	1 fair	
	5 p. m.	29	9 15	6 1	6 W.	2 cloudy	
6	9 a. m.	30	0 15	0 1	5 S. E.	2 fair	0,045
	5 p. m.	30	0 15	7 1	5 S. W.	2 fair	
7	8 a. m.	30	1 14	5 1	5 W.	2 cloudy	
	9 p. m.	30	0 15	6 1	6 W.	0 fair	
8	9 a. m.	29	9 15	1 1	4 W.	3 fair	
	8 p. m.	29	9 14	2 1	4 W.	2 cloudy	
9	9 a. m.	29	7 14	3 1	6 W.	3 cloudy	
	5 p. m.	29	7 14	3 1	6 W.	3 cloudy	
10	9 a. m.	29	7 13	8 1	3 N. W.	3 fair	0,145
	8 p. m.	29	8 13	5 1	2 N. W.	3 cloudy	
11	9 a. m.	29	8 14	2 1	5 W.	3 fair	
	5 p. m.	29	8 14	9 1	5 W.	3 cloudy	
12	9 a. m.	29	8 13	9 1	6 W.	2 cloudy	
	5 p. m.	29	7 15	0 1	6 W.	1 cloudy	
13	9 a. m.	29	6 14	5 1	7 W.	2 fair	
	5 p. m.	29	5 15	3 1	4 W.	3 fair	
14	9 a. m.	29	6 12	2 2	1 N. E.	2 cloudy	0,093
	7 p. m.	29	6 13	2 1	4 N. E.	1 fair	
15	9 a. m.	29	6 14	6 1	4 N. E.	1 fair	
	8 p. m.	29	6 13	7 1	3 N. E.	1 fair	
16	8 a. m.	29	6 13	1 2	2 E.	2 Rain	
	5 p. m.	29	6 12	7 2	8 N. E.	2 cloudy	

and Observations.

J V L Y 1733.

D.	Hour.	Baro.		Ther.		Hyg.		Wind.		Weather.	Rain.
		In.	D.	In.	D.	I.	D.	Dir.	For.		
											0,283
17	8 a. m.	29	6	13	4	3	5	N. E.	2	Cloudy	
	4 p. m.	29	6	14	0	2	0	N. E.	1	cloudy	
18	9 a. m.	29	7	14	1	2	0	N.	1	fair	0,054
	9 p. m.	29	7	14	0	1	6	N. E.	0	fair	
19	8 a. m.	29	7	13	6	1	6	N. W.	2	fair	
	8 p. m.	29	7	14	1	1	7	N. W.	2	fair	
20	9 a. m.	29	8	14	0	1	6	W.	2	fair	
	5 p. m.	29	8	15	4	1	4	W.	2	fair	
21	8 a. m.	29	7	14	0	2	0	W.	2	fair	
	7 p. m.	29	7	15	6	1	2	N. W.	1	fair	
22	9 a. m.	29	8	15	5	1	5	W.	2	fair	
	6 p. m.	29	8	15	5	1	3	W.	2	fair	
23	9 a. m.	29	8	14	9	1	6	W.	2	cloudy	
	5 p. m.	29	8	15	8	1	6	W.	3	cloudy	
24	9 a. m.	29	8	15	1	2	0	W.	2	fair	
	5 p. m.	29	8	15	3	1	4	W.	2	fair	
25	8 a. m.	29	9	14	0	1	7	W.	2	fair	0,115
	5 p. m.	29	9	14	8	1	3	W.	3	fair	
26	9 a. m.	29	8	14	4	1	5	W.	3	fair	
	8 p. m.	29	8	14	0	1	5	W.	2	fair	
27	8 a. m.	29	8	13	3	1	6	W.	2	fair	
	5 p. m.	29	8	14	8	1	0	W.	2	fair	
28	9 a. m.	29	7	14	7	1	4	S.	1	Fog	
	4 p. m.	29	6	15	3	1	3	S. b. W.	0	cloudy	
29	9 a. m.	29	5	14	3	1	5	E.	1	fair	0,186
	7 p. m.	29	4	14	3	1	9	W.	1	cloudy	
30	8 a. m.	29	4	13	8	2	0	N. b. W.	1	fair	
	5 p. m.	29	4	14	5	1	1	N. W.	2	fair	
31	8 a. m.	29	4	13	0	1	7	W.	2	fair	
	7 p. m.	29	4	13	2	1	4	N. W.	2	fair	
H. at a med.		29	7	14	6	1	6	Total Depth			0,638
Gr. Height		30	1	15	8	3	5				
L. Height		29	4	12	2	1	0				

AUGUST 1733.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29	513	51	3 W.	2 Cloudy	
	6 p. m.	29	613	91	3 N. W.	1 fair	
2	9 a. m.	29	612	71	5 W.	1 fair	
	8 p. m.	29	613	81	0 E.	1 fair	
3	9 a. m.	29	613	61	3 E.	1 fair	
	8 p. m.	29	513	51	4 E.	1 fair	
4	9 a. m.	29	413	31	5 S. E.	2 cloudy	
	8 p. m.	29	513	61	5 E.	1 cloudy	
5	9 a. m.	29	513	81	8 E.	1 cloudy	
	8 p. m.	29	513	51	8 E.	1 Rain	
6	9 a. m.	29	414	42	4 E.	1 Rain	0,056
	8 p. m.	29	413	33	1 E.	1 Fog	
7	9 a. m.	29	413	73	1 E.	2 cloudy	0,093
	7 p. m.	29	413	63	2 N. E.	1 Fog	
8	9 a. m.	29	413	63	3 N. E.	1 cloudy	
	8 p. m.	29	513	62	2 W.	1 cloudy	
9	9 a. m.	29	713	11	9 N. W.	0 cloudy	
	5 p. m.	29	714	81	5 N. W.	0 fair	
10	9 a. m.	29	713	61	8 S. W.	0 cloudy	0,075
	7 p. m.	29	713	41	9 S. E.	1 cloudy	
11	8 a. m.	29	712	42	0 W.	1 fair	
	6 p. m.	29	814	51	3 W.	1 fair	
12	9 a. m.	29	715	01	4 S. W.	4 cloudy	0,035
	6 p. m.	29	713	51	3 S. W.	4 cloudy	
13	8 a. m.	29	713	11	4 W.	2 fair	
	5 p. m.	29	814	31	2 W.	1 fair	
14	9 a. m.	29	414	11	3 S. W.	3 fair	0,188
	4 p. m.	29	413	81	4 W.	3 fair	
15	9 a. m.	29	712	41	7 W.	1 fair	0,210
	5 p. m.	29	714	01	4 W.	1 cloudy	
16	9 a. m.	29	612	01	8 N. W.	1 Rain	0,490
	4 p. m.	29	713	01	7 N. W.	0 cloudy	

AUGUST 1733.

D.	Hour.	Baro.		Ther.		Hyg.		Wind.		Weather.	Rain.	
		In.	D.	In.	D.	I.	D.	Dir.	For.			
17	9 a. m.	29	7	12	4	1	6	S. W.	2	Fair	1,147	
	5 p. m.	29	4	13	2	1	6	S. W.	4	cloudy	0,365	
18	9 a. m.	29	3	13	6	2	0	S. W.	3	cloudy		
	5 p. m.	29	2	13	4	1	8	S. W.	3	cloudy		
19	9 a. m.	29	7	12	5	1	5	N. W.	2	cloudy	0,154	
	7 p. m.	29	8	13	0	1	3	N. W.	0	cloudy		
20	8 a. m.	29	7	13	8	1	7	S. W.	0	Rain		
	5 p. m.	29	6	15	0	1	9	S. W.	1	cloudy		
21	8 a. m.	29	6	14	1	2	3	S. W.	2	cloudy		
	7 p. m.	29	6	12	9	1	9	W.	1	cloudy		
22	8 a. m.	29	7	12	6	1	9	W.	1	fair		
	7 p. m.	29	7	12	9	1	5	W.	1	fair		
23	9 a. m.	29	8	12	7	1	8	W.	1	fair	0,193	
	7 p. m.	29	8	13	2	1	4	W.	1	fair		
24	9 a. m.	29	7	13	2	1	4	S. W.	2	cloudy	0,055	
	6 p. m.	29	5	13	9	1	5	S. W.	3	fair		
25	9 a. m.	29	5	12	3	1	5	W.	2	fair		
	7 p. m.	29	6	12	3	1	5	W.	2	fair		
26	9 a. m.	29	6	12	9	1	6	N. W.	2	fair		
	6 p. m.	29	7	13	2	1	2	N. W.	1	fair		
27	9 a. m.	29	6	12	8	1	9	S. W.	1	cloudy	0,100	
	7 p. m.	29	6	12	8	1	6	W.	1	fair		
28	9 a. m.	29	5	11	5	1	6	W.	1	fair		
	6 p. m.	29	4	12	7	1	6	S.	0	cloudy		
29	9 a. m.	29	1	12	1	1	9	S. W.	1	Rain	0,286	
	5 p. m.	29	1	12	6	1	5	W.	1	fair		
30	9 a. m.	29	4	12	5	1	4	N. W.	2	fair	0,375	
	5 p. m.	29	5	13	0	1	3	N. W.	1	fair		
31	9 a. m.	29	3	12	1	1	9	S.	1	Rain		
	6 p. m.	29	2	12	4	1	4	W.	2	fair		
H. at a med.		29	6	13	2	1	7	Total Depth				2,675
Gr. Height		29	8	15	0	3	3					
L. Height		29	1	12	1	1	0					

S E P T E M B E R 1733.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29	2 12	6 1	7 S. W.	2 Fair	0,084
	6 p. m.	29	0 11	5 1	5 W.	2 cloudy	
2	9 a. m.	28	9 12	7 1	5 S. W.	1 cloudy	0,055
	6 p. m.	29	0 12	6 1	6 E.	1 fair	
3	8 a. m.	29	2 12	0 1	7 N. W.	2 cloudy	
	4 p. m.	29	4 12	8 1	2 N. W.	2 fair	
4	9 a. m.	29	5 12	0 1	7 S. W.	3 fair	0,230
	4 p. m.	29	2 11	5 1	5 S. W.	2 Rain	
5	9 a. m.	29	0 12	2 1	8 S. W.	3 fair	0,067
	5 p. m.	29	3 12	4 1	5 W.	3 fair	
6	8 a. m.	29	6 11	3 2	0 W.	2 fair	
	6 p. m.	29	7 12	3 1	4 S. W.	2 fair	
7	8 a. m.	29	6 11	4 1	6 W.	2 fair	
	5 p. m.	29	7 12	1 1	5 W.	2 fair	
8	9 a. m.	29	8 11	0 1	9 W.	2 fair	0,108
	6 p. m.	29	9 11	0 1	5 N.	2 cloudy	
9	9 a. m.	30	0 10	5 1	6 N.	2 fair	
	5 p. m.	30	1 12	1 1	3 N. b. W.	1 fair	
10	8 a. m.	30	1 11	3 1	5 S. W.	1 fair	
	5 p. m.	30	1 12	3 1	3 S. b. E.	1 fair	
11	8 a. m.	30	1 11	3 1	5 S. b. E.	2 fair	
	4 p. m.	30	0 13	5 1	2 S. b. E.	2 fair	
12	8 a. m.	29	8 11	9 1	7 S. E.	2 fair	0,077
	5 p. m.	29	7 13	4 1	6 S. E.	2 Rain	
13	8 a. m.	29	8 13	3 1	9 S.	1 Rain	0,030
	5 p. m.	29	8 14	3 1	8 S.	1 cloudy	
14	9 a. m.	29	9 13	0 3	0 S. E.	1 Mist	0,026
	5 p. m.	29	9 13	4 2	8 S. E.	1 Mist	
15	9 a. m.	30	0 12	5 3	3 S. E.	1 Mist	
	5 p. m.	30	0 12	3 3	2 E.	2 Mist	
16	9 a. m.	30	0 12	2 2	7 E.	2 Fog	
	5 p. m.	30	0 11	3 2	1 E.	1 fair	

S E P T E M B E R 1733.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather	Rain.
							0,677
17	9 a. m.	30	1 12	0 2	1 E.	1 Fog	
	5 p. m.	30	1 13	0 1	9 E.	1 Cloudy	
18	8 a. m.	30	2 12	3 2	1 S. W.	1 cloudy	
	5 p. m.	30	2 13	0 2	1 S. W.	1 cloudy	
19	9 a. m.	30	2 13	2 2	4 S. W.	2 fair	
	5 p. m.	30	1 13	8 1	7 W.	2 fair	
20	9 a. m.	29	9 13	6 1	9 S. W.	2 cloudy	
	4 p. m.	29	9 13	8 2	0 S. W.	2 Rain	
21	9 a. m.	29	8 11	9 2	2 W. b. S.	2 fair	0,356
	6 p. m.	29	9 11	7 2	0 S. W.	2 fair	
22	9 a. m.	29	9 12	2 2	5 W.	2 fair	
	5 p. m.	29	9 12	8 1	9 W.	1 fair	
23	9 a. m.	29	8 12	5 2	0 S. W.	1 fair	0,240
	4 p. m.	29	7 13	1 1	6 S. W.	1 fair	
24	9 a. m.	29	4 12	5 2	2 S. W.	2 fair	
	5 p. m.	29	3 13	2 1	7 S.	2 lowring	
25	9 a. m.	29	1 11	0 1	9 S. W.	2 fair	
	5 p. m.	28	9 11	8 1	8 S. b. W.	2 Rain	
26	9 a. m.	28	4 10	8 2	0 S. W.	4 cloudy	0,395
	5 p. m.	28	6 10	5 1	7 S. W.	3 cloudy	
27	9 a. m.	28	9 11	1 1	8 W.	3 fair	0,094
	4 p. m.	29	2 11	8 1	5 W.	3 fair	
28	9 a. m.	29	1 12	3 2	1 S. W.	2 cloudy	
	5 p. m.	29	1 12	3 1	7 S. W.	4 cloudy	
29	9 a. m.	29	4 11	7 1	8 W.	4 cloudy	
	5 p. m.	29	5 11	6 1	7 W.	3 fair	
30	9 a. m.	29	7 11	4 1	9 W.	2 fair	0,073
	5 p. m.	29	7 11	7 1	7 W.	1 cloudy	
H. atamed.		29	6 12	2 1	9	Total Depth 1,835	
Gr. Height		30	2 13	8 3	3		
L. Height		28	4 10	5 1	2		

OCTOBER 1733.

D.	Hour.	Baro.	Ther.	Hyg.	Wind.	Weather.	Rain.
		In. D.	In. D.	I. D.	Dir. For.		In. D.
1	9 a. m.	29 8	11 2	2 5	S. W.	1 Rain	0,045
	5 p. m.	29 5	12 4	1 9	S. W.	1 cloudy	
2	9 a. m.	29 5	13 3	2 1	S. W.	1 cloudy	
	5 p. m.	29 4	13 7	1 8	S. W.	3 cloudy	
3	9 a. m.	29 1	12 9	1 7	S. W.	4 cloudy	0,060
	5 p. m.	29 1	12 5	1 7	S. W.	4 fair	
4	9 a. m.	29 5	11 6	2 0	W.	2 fair	
	5 p. m.	29 7	11 8	1 5	N. W.	2 fair	
5	9 a. m.	30 1	10 6	1 3	W. b. N.	1 fair	
	4 p. m.	30 2	11 0	1 4	W. b. N.	1 fair	
6	9 a. m.	30 3	9 9	1 7	N. W.	1 fair	
	5 p. m.	30 4	10 4	1 7	N. W.	0 fair	
7	9 a. m.	30 4	10 5	1 8	S. W.	1 cloudy	
	4 p. m.	30 2	11 3	1 7	S. W.	1 cloudy	
8	9 a. m.	30 0	11 4	1 7	S. W.	1 fair	
	5 p. m.	30 0	11 7	1 7	W. b. S.	2 cloudy	
9	9 a. m.	30 0	11 4	2 6	N. E.	2 Rain	
	5 p. m.	30 0	10 9	2 7	E.	2 Fog	
10	9 a. m.	29 9	11 1	2 4	S. E.	1 cloudy	0,124
	5 p. m.	29 8	11 4	2 2	S. E.	2 cloudy	
11	9 a. m.	29 7	11 3	2 3	S. E.	1 cloudy	
	5 p. m.	29 6	11 3	2 0	E.	2 cloudy	
12	9 a. m.	29 5	11 2	2 4	S. E.	1 lowring	
	5 p. m.	29 4	11 3	2 3	E.	1 cloudy	
13	9 a. m.	29 4	9 1	2 2	N. W.	2 fair	
	5 p. m.	29 5	10 7	2 1	N. W.	3 cloudy	
14	9 a. m.	29 7	10 2	1 9	N. W.	2 fair	
	5 p. m.	29 8	10 4	1 5	N. W.	2 fair	
15	9 a. m.	30 0	9 4	1 7	N. W.	2 fair	
	5 p. m.	30 0	10 2	1 7	N. W.	2 fair	
16	9 a. m.	30 1	10 1	2 0	N. W.	1 fair	
	5 p. m.	30 2	10 8	1 7	N. W.	1 fair	

OCTOBER 1733.

D.	Hour.	Baro.		Ther.		Hyg.		Wind.		Weather.	Rain.
		In.	D.	In.	D.	I.	D.	Dir.	For.		
											0,229
17	9 a. m.	30	3	8	9	1	9	W.b.N.	1	Fair	
	5 p. m.	30	3	9	4	1	7	W.b.N.	1	fair	
18	9 a. m.	30	4	9	9	1	9	S. W.	1	fair	
	4 p. m.	30	4	11	0	1	8	S.	1	fair	
19	9 a. m.	30	4	10	8	1	9	S. W.	1	fair	
	4 p. m.	30	4	11	5	1	8	W.	0	fair	
20	9 a. m.	30	3	10	0	1	8	W.	2	fair	0,030
	4 p. m.	30	3	11	0	1	7	W.	2	fair	
21	9 a. m.	30	3	10	6	1	7	W.	0	cloudy	
	4 p. m.	30	2	11	1	1	7	W.	2	cloudy	
22	9 a. m.	30	1	10	7	2	0	S. W.	2	fair	
	5 p. m.	30	1	10	8	2	0	W.	2	fair	
23	9 a. m.	30	0	10	6	2	0	W.	0	cloudy	
	4 p. m.	29	9	11	0	2	0	W.	0	cloudy	
24	9 a. m.	29	7	10	1	2	0	S. W.	0	fair	
	4 p. m.	29	5	10	8	1	7	S. W.	2	cloudy	
25	9 a. m.	29	0	11	5	2	2	S. W.	2	cloudy	
	4 p. m.	28	9	11	9	1	7	S. W.	2	cloudy	
26	9 a. m.	29	0	10	8	1	9	S. W.	3	fair	
	4 p. m.	29	1	11	2	2	0	S. W.	3	loudy	
27	9 a. m.	29	1	10	1	1	9	S. W.	3	loudy	0,206
	4 p. m.	29	2	9	8	1	8	S. W.	3	Rain	
28	9 a. m.	29	4	10	3	2	0	S. W.	2	loudy	0,154
	4 p. m.	29	3	11	9	2	4	S. W.	3	Rain	
29	9 a. m.	29	1	11	7	2	4	S. W.	4	loudy	0,380
	4 p. m.	29	1	10	6	1	9	W.	4	cloudy	
30	9 a. m.	29	7	9	0	1	6	W.	2	cloudy	0,084
	4 p. m.	30	0	9	2	1	4	N. W.	2	cloudy	
31	9 a. m.	30	2	9	3	1	5	S. W.	2	cloudy	
	5 p. m.	29	9	11	3	1	9	S. W.	3	cloudy	
H. ata med.		29	8	10	9	1	9	Total Depth 1,083			
Gr. Height		30	4	13	7	2	7				
L. Height		28	9	8	9	1	3				

NOVEMBER 1733.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29	71	22	3 S. W.	3 Cloudy	
	4 p. m.	29	71	42	3 S. W.	2 cloudy	
2	9 a. m.	29	71	42	3 W.	3 fair	0,043
	5 p. m.	29	71	82	2 W.	3 cloudy	
3	9 a. m.	29	81	61	8 W.	2 cloudy	
	4 p. m.	29	91	21	7 W.	2 fair	
4	9 a. m.	30	3	9	41	8 N.	1 fair
	4 p. m.	30	31	01	7 N.	1 cloudy	
5	9 a. m.	30	11	62	5 N.	3 cloudy	
	4 p. m.	30	11	02	3 W.	2 cloudy	
6	9 a. m.	30	21	82	3 W.	0 cloudy	
	4 p. m.	30	31	92	2 W.	1 cloudy	
7	9 a. m.	30	31	52	0 W.	1 cloudy	0,085
	5 p. m.	30	21	81	7 W.	1 cloudy	
8	9 a. m.	30	01	42	0 S.	0 cloudy	
	5 p. m.	29	91	52	0 S.	3 cloudy	
9	9 a. m.	29	81	82	2 S. W.	2 fair	
	4 p. m.	29	71	31	9 S. W.	2 fair	
10	9 a. m.	29	21	71	8 S. W.	3 fair	
	4 p. m.	29	1	9	91	9 S. W.	4 cloudy
11	9 a. m.	29	2	9	12	0 W.	2 fair
	4 p. m.	29	2	9	72	0 W.	2 cloudy
12	9 a. m.	29	2	8	22	0 N. W.	2 fair
	4 p. m.	29	5	9	41	9 N. W.	2 fair
13	9 a. m.	29	7	9	32	0 S. W.	2 cloudy
	4 p. m.	29	61	82	0 S. W.	2 cloudy	0,066
14	9 a. m.	29	41	02	0 S. W.	3 cloudy	
	5 p. m.	29	61	52	0 S. W.	2 cloudy	
15	9 a. m.	29	61	42	3 S. W.	2 cloudy	
	5 p. m.	29	51	72	0 S. W.	4 cloudy	
16	9 a. m.	29	8	9	82	0 S. W.	2 fair
	5 p. m.	29	8	9	81	9 S. W.	2 fair

N O V E M B E R 1733.

D.	Hour.	Baro.		Ther.		Hyg.		Wind.		Weather.	Rain.	
		In.	D.	In.	D.	I.	D.	Dir.	For.			
											0,194	
17	9 a. m.	29	5	10	6	2	0	S.	4	Cloudy		
	5 p. m.	29	6	9	9	1	9	W.	2	cloudy		
18	9 a. m.	29	8	9	7	2	0	S. W.	2	fair		
	4 p. m.	29	8	10	4	1	9	S. W.	2	fair		
19	9 a. m.	29	7	9	6	2	0	S. W.	2	fair		
	4 p. m.	29	8	10	4	2	0	S. W.	2	fair		
20	9 a. m.	29	7	11	0	2	1	S.	2	cloudy		
	4 p. m.	29	6	10	6	1	9	S.	2	cloudy		
21	9 a. m.	29	5	10	9	2	0	S. E.	2	fair		
	4 p. m.	29	6	11	3	2	0	S. E.	2	Fair		
22	9 a. m.	29	8	11	7	2	1	S.	1	fair		
	4 p. m.	29	8	11	9	2	0	S.	1	fair		
23	9 a. m.	29	8	11	5	2	1	S. W.	2	fair		
	4 p. m.	29	7	11	5	2	0	S. W.	3	cloudy		
24	9 a. m.	29	7	11	9	2	7	S. W.	2	cloudy		
	4 p. m.	29	6	12	4	2	4	S. W.	2	cloudy		
25	9 a. m.	29	7	10	2	1	9	W.	3	fair	0,037	
	4 p. m.	29	7	10	3	1	9	W.	3	fair		
26	9 a. m.	29	7	10	2	2	0	W.	3	fair		
	4 p. m.	29	5	9	4	2	5	W.	4	Rain		
27	9 a. m.	29	8	9	5	1	8	W.	2	fair		
	4 p. m.	29	9	10	2	1	8	W.	2	cloudy		
28	9 a. m.	29	8	11	0	2	4	W.	2	fair		
	4 p. m.	29	7	11	1	1	9	W.	3	cloudy		
29	9 a. m.	29	8	11	0	2	0	W.	2	cloudy		
	4 p. m.	29	7	11	8	2	2	W.	3	Rain		
30	9 a. m.	29	5	11	5	2	0	S. W.	3	fair	0,095	
	4 p. m.	29	6	9	7	1	9	S. W.	3	cloudy		
H. at a med.		29	7	10	8	2	0	Total Depth				0,326
Gr. Height		30	3	12	7	2	7					
L. Height		29	1	8	2	1	7					

D E C E M B E R 1733.

D.	Hour.	Baro. In.D.	Ther. In.D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In.D.
1	9 a. m.	29 6	9 3	2 0	W.	2 Fair	0,205
	4 p. m.	29 6	9 2	2 0	W.	2 fair	
2	9 a. m.	29 4	12 0	2 6	W.	4 cloudy	0,146
	4 p. m.	29 3	11 1	2 1	W.	4 fair	
3	9 a. m.	29 7	9 6	1 7	W.	2 fair	0,072
	4 p. m.	29 9	10 1	1 9	W.	2 fair	
4	9 a. m.	30 0	11 2	2 2	W.	2 cloudy	
	4 p. m.	30 1	11 4	2 3	W.	2 fair	
5	9 a. m.	30 2	11 1	2 1	W.	1 cloudy	
	4 p. m.	30 2	11 4	2 1	S. W.	2 cloudy	
6	9 a. m.	30 2	10 7	2 0	S. W.	2 cloudy	
	4 p. m.	30 1	11 1	2 9	S. W.	1 cloudy	
7	9 a. m.	30 0	10 0	2 0	S. W.	1 cloudy	
	4 p. m.	30 0	10 2	2 9	S. W.	1 cloudy	
8	9 a. m.	30 0	9 7	2 0	S. W.	1 fair	
	4 p. m.	29 9	10 7	2 0	S. W.	1 fair	
9	9 a. m.	29 7	9 0	2 9	S. W.	1 Fog	
	4 p. m.	29 6	9 5	2 9	S. W.	1 cloudy	
10	9 a. m.	29 1	10 5	2 2	S.	2 cloudy	
	4 p. m.	29 3	10 2	2 1	S. W.	2 cloudy	
11	9 a. m.	29 0	11 5	2 4	S. W.	4 Rain	0,248
	4 p. m.	29 0	12 0	2 2	S. W.	4 Rain	
12	9 a. m.	29 1	10 7	2 9	S.	1 fair	0,153
	4 p. m.	29 0	11 8	2 1	S.	1 fair	
13	9 a. m.	29 1	10 7	2 2	S.	0 Fog	0,124
	4 p. m.	29 0	10 8	2 1	S. W.	2 cloudy	
14	9 a. m.	29 0	10 9	2 0	S.	2 Fog	0,176
	4 p. m.	28 8	11 4	2 2	S.	2 cloudy	
15	9 a. m.	29 2	11 1	2 1	S. W.	3 cloudy	0,198
	4 p. m.	29 3	10 9	2 9	S. W.	4 cloudy	
16	9 a. m.	29 2	10 3	2 2	S.	2 Rain	0,354
	4 p. m.	29 3	9 9	2 3	N. W.	1 fair	

D E C E M B E R 1733.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain.
							1,666
17	9 a. m.	29	4 10	0 2	4 W.	2 Rain	0,565
	4 p. m.	29	4 10	3 2	5 W.	1 fair	
18	9 a. m.	29	4 12	6 2	3 S. W.	4 fair	0,223
	4 p. m.	29	4 12	5 2	5 S. W.	3 fair	
19	9 a. m.	29	6 11	5 2	2 S. W.	2 fair	
	4 p. m.	29	7 11	7 2	2 W.	1 fair	
20	9 a. m.	29	7 11	7 2	2 S. E.	1 cloudy	0,274
	4 p. m.	29	7 11	7 2	2 S. W.	1 cloudy	
21	9 a. m.	29	6 11	9 2	3 S.	0 Fog	0,074
	4 p. m.	29	6 11	3 2	1 W.	1 fair	
22	9 a. m.	29	5 10	3 2	1 S. W.	1 fair	0,155
	4 p. m.	29	1 10	7 2	2 S. W.	3 cloudy	
23	9 a. m.	29	2 10	2 1	9 S. W.	2 fair	0,130
	4 p. m.	29	3 10	6 1	8 S. W.	2 fair	
24	9 a. m.	29	3 9	7 2	8 S. W.	2 fair	0,195
	4 p. m.	29	5 9	7 2	0 W.	2 fair	
25	9 a. m.	29	4 9	9 2	1 W.	2 cloudy	0,055
	4 p. m.	29	4 9	5 2	1 W. b. S.	2 cloudy	
26	9 a. m.	29	6 8	9 2	1 W. b. S.	2 fair	0,124
	4 p. m.	29	7 9	4 2	0 W. b. S.	2 fair	
27	9 a. m.	29	2 9	0 2	2 W.	1 Fog	
	4 p. m.	29	4 10	4 2	2 W.	1 fair	
28	9 a. m.	29	8 10	2 2	3 S. W.	0 Fog	0,093
	4 p. m.	29	9 10	6 2	1 S. W.	1 Cloudy	
29	9 a. m.	29	6 11	7 2	1 S. W.	3 cloudy	
	4 p. m.	29	6 10	7 1	9 S. W.	2 fair	
30	9 a. m.	29	5 11	0 2	0 S. W.	3 Rain	0,075
	4 p. m.	29	4 11	7 2	2 S. W.	3 fair	
31	9 a. m.	29	2 11	3 2	2 S. W.	3 cloudy	
	4 p. m.	29	3 11	1 2	1 W.	2 cloudy	
H. at a med.		29	5 10	7 2	1	Total Depth 3,629	
Gr. Height		30	2 12	6 2	8		
L. Height		28	8 8	9 1	7		

JANUARY 1734.

D.	Hour.	Baro. In D.	Ther. In.D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In.D.
1	9 a. m.	29 4	8 6	2 3	S. W.	3 Cloudy	
	4 p. m.	29 6	9 3	2 0	W.	3 cloudy	
2	9 a. m.	29 6	9 6	2 0	S.	3 cloudy	
	4 p. m.	29 4	9 3	2 1	S. W.	2 Rain	
3	9 a. m.	29 3	8 4	2 3	W.	2 fair	
	4 p. m.	29 3	8 5	2 1	W.	2 fair	
4	9 a. m.	29 2	8 3	2 2	S. W.	2 fair	
	4 p. m.	29 2	8 3	2 1	S. W.	2 fair	
5	9 a. m.	29 2	7 8	2 3	S. W.	2 cloudy	
	4 p. m.	29 3	7 3	2 5	S. W.	2 cloudy	
6	9 a. m.	29 6	7 4	2 0	W.	2 fair	0,085
	4 p. m.	29 6	7 7	2 1	9 W.	1 fair	
7	9 a. m.	29 7	7 1	2 1	9 W.	2 fair	
	4 p. m.	29 8	7 7	2 6	W.	1 Fog	
8	9 a. m.	30 0	8 0	2 8	S. W.	1 Fog	
	4 p. m.	30 0	8 8	2 6	S. W.	1 Fog	
9	9 a. m.	30 0	9 0	2 0	S. b. W.	1 cloudy	0,055
	4 p. m.	30 0	9 3	2 0	S.	1 cloudy	
10	9 a. m.	30 2	8 7	2 5	S.	1 cloudy	
	4 p. m.	30 3	9 1	2 5	S.	1 cloudy	
11	9 a. m.	30 5	7 7	2 8	S.	1 fair	0,095
	4 p. m.	30 5	7 5	2 7	S.	1 fair	
12	9 a. m.	30 5	7 0	2 7	S. W.	1 fair	
	4 p. m.	30 6	7 6	2 6	S. W.	1 fair	
13	9 a. m.	30 5	6 2	2 5	S. W.	1 fair	
	4 p. m.	30 4	7 4	2 7	S. W.	2 fair	
14	9 a. m.	30 2	7 0	2 0	S. W.	1 fair	
	4 p. m.	30 1	7 4	2 2	S. W.	1 fair	
15	9 a. m.	30 0	7 0	2 6	S. b. E.	1 Fog	0,173
	4 p. m.	29 9	7 3	2 5	S. b. E.	1 Fog	
16	9 a. m.	29 7	7 6	2 5	S.	1 Fog	
	4 p. m.	29 7	8 2	2 3	S.	1 fair	—
							0,408

JANUARY 1734.

D.	Hour.	Baro.		Ther.		Hyg.		Wind.		Weather.	Rain.	
		In.	D.	In.	D.	I.	D.	Dir.	For.			
											0,408	
17	9 a. m.	29	8	8	0	2	5	S.	1	Fog		
	4 p. m.	30	0	8	5	2	4	S. W.	1	cloudy		
18	9 a. m.	29	9	10	0	2	1	S. W.	3	cloudy		
	4 p. m.	30	0	11	2	2	3	S. W.	1	cloudy		
19	9 a. m.	30	0	10	7	2	3	S. W.	1	cloudy		
	4 p. m.	30	1	10	5	2	1	S. W.	2	fair		
20	9 a. m.	30	1	9	8	2	0	S. W.	1	fair		
	4 p. m.	30	1	9	8	2	0	S. W.	1	fair		
21	9 a. m.	30	0	8	9	2	0	S. W.	1	fair		
	4 p. m.	29	8	10	0	1	9	S. W.	1	fair		
22	9 a. m.	29	4	9	4	2	1	S. W.	2	fair		
	4 p. m.	29	4	9	7	2	1	W.	2	fair		
23	9 a. m.	29	8	9	5	1	9	W.	2	fair		
	4 p. m.	29	8	10	4	1	2	W.	2	fair		
24	9 a. m.	29	8	11	1	2	5	W.	2	cloudy		
	4 p. m.	29	7	11	5	2	4	W.	2	Rain		
25	9 a. m.	29	6	10	4	2	1	W. b. S.	3	cloudy	0,065	
	4 p. m.	29	3	9	9	2	1	W. b. S.	3	cloudy		
26	9 a. m.	29	8	10	1	2	0	N. W.	2	fair		
	4 p. m.	29	9	10	8	1	8	W.	3	fair		
27	9 a. m.	30	2	11	0	2	6	W.	2	fair		
	4 p. m.	30	2	11	2	2	3	W.	3	cloudy		
28	9 a. m.	30	2	10	7	2	5	S. W.	2	fair	0,045	
	4 p. m.	30	2	11	4	2	4	W.	2	fair		
29	9 a. m.	30	3	11	0	2	5	W.	2	cloudy		
	4 p. m.	30	3	10	8	2	5	W. b. S.	2	cloudy		
30	9 a. m.	30	3	11	2	2	5	W.	2	cloudy	0,075	
	4 p. m.	30	2	11	2	2	3	W.	2	cloudy		
31	9 a. m.	30	2	10	2	2	1	W.	2	fair		
	4 p. m.	30	2	9	4	1	5	N. W.	3	fair		
H. atamed.		29	9	8	8	2	2	Total Depth				0,593
Gr. Height		30	6	11	5	2	8					
L. Height		29	2	6	2	1	2					

F E B R U A R Y 1734.

D.	Hour.	Baro.	Ther.	Hyg.	Wind.	Weather.	Rain.				
		In. D	In. D.	I. D.	Dir. For.		In.D.				
1	9 a. m.	30	2	9	0	1	9	W. b. S.	2	Fair	
	4 p. m.	30	1	10	4	2	1	W.	3	cloudy	
2	9 a. m.	30	0	10	6	2	1	W.	4	fair	
	4 p. m.	30	0	11	0	2	0	W.	3	fair	
3	9 a. m.	29	9	10	8	2	3	S. W.	2	fair	
	4 p. m.	29	7	11	2	2	2	W.	3	fair	
4	9 a. m.	29	9	9	9	1	9	W.	3	fair	0,114
	5 p. m.	29	8	10	3	2	0	W.	3	cloudy	
5	9 a. m.	29	8	10	8	2	3	W.	2	cloudy	
	4 p. m.	29	9	11	4	2	1	W.	2	cloudy	
6	9 a. m.	29	8	10	9	2	2	S. W.	2	cloudy	
	4 p. m.	29	6	11	0	2	0	S. W.	3	cloudy	
7	9 a. m.	29	6	10	3	2	0	W. b. N.	3	fair	0,094
	4 p. m.	29	8	10	4	1	4	N. W.	3	fair	
8	9 a. m.	30	3	9	9	1	6	W.	1	cloudy	
	4 p. m.	30	3	10	5	2	0	W.	2	cloudy	
9	9 a. m.	30	2	11	0	2	3	S. b. W.	3	cloudy	
	4 p. m.	30	0	11	3	2	0	S. W.	2	cloudy	
10	9 a. m.	29	9	10	4	2	0	N. W.	3	fair	0,243
	4 p. m.	30	0	10	6	1	8	N. W.	3	fair	
11	9 a. m.	30	0	10	7	1	9	S. W.	2	cloudy	
	4 p. m.	29	9	11	1	1	8	S. W.	2	cloudy	
12	9 a. m.	29	6	11	7	2	0	S. W.	2	cloudy	
	4 p. m.	29	6	11	8	1	7	S. W.	1	cloudy	
13	9 a. m.	29	4	11	8	2	0	S. W.	2	fair	0,023
	4 p. m.	29	5	11	5	1	6	S. W.	2	fair	
14	9 a. m.	29	6	9	8	1	7	S. W.	2	fair	
	4 p. m.	29	5	9	6	1	5	S. W.	3	cloudy	
15	9 a. m.	28	8	10	5	2	0	S. b. W.	4	Rain	
	4 p. m.	28	6	10	2	2	0	S. W.	4	cloudy	
16	9 a. m.	29	0	9	2	2	0	S. W.	3	fair	
	4 p. m.	29	0	9	4	2	0	W.	2	cloudy	

F E B R U A R Y 1734.

D.	Hour.	Baro.		Ther.		Hyg.		Wind.		Weather.	Rain.
		In.	D.	In.	D.	I.	D.	Dir.	For.		
17	9 a. m.	29	0	9	2	1	8	S. W.	3	Cloudy	0,474
	5 p. m.	29	1	8	6	2	2	S. W.	3	cloudy	
18	9 a. m.	29	0	9	9	2	1	N. W.	3	cloudy	0,065
	5 p. m.	29	5	10	4	1	5	N.	4	fair	
19	9 a. m.	29	7	9	1	1	7	N. W.	2	fair	0,065
	4 p. m.	29	5	10	2	1	7	W.	2	Rain	
20	8 a. m.	29	5	9	1	2	0	N. W.	3	cloudy	0,056
	5 p. m.	29	7	9	7	1	5	N. W.	2	fair	
21	9 a. m.	29	9	9	1	1	9	W.	3	cloudy	0,056
	4 p. m.	29	9	9	6	2	0	W.	2	Rain	
22	9 a. m.	29	7	10	9	2	6	S. W.	2	fair	0,056
	5 p. m.	29	5	11	6	2	1	S. W.	2	cloudy	
23	9 a. m.	29	3	10	9	2	1	S. W.	2	cloudy	0,056
	5 p. m.	29	3	11	5	1	7	S. W.	2	cloudy	
24	9 a. m.	28	9	10	6	2	0	S. W.	2	cloudy	0,056
	5 p. m.	28	9	10	6	1	7	W.	1	fair	
25	8 a. m.	29	0	10	1	2	2	S.	1	cloudy	0,056
	5 p. m.	29	1	10	8	2	1	S.	1	cloudy	
26	9 a. m.	29	3	9	6	2	1	S.	1	fair	0,056
	4 p. m.	29	3	10	8	2	0	S.	1	fair	
27	9 a. m.	29	6	9	7	2	0	S. W.	0	fair	0,056
	4 p. m.	29	6	11	4	1	6	S. W.	2	cloudy	
28	9 a. m.	29	4	11	4	1	8	S.	4	cloudy	0,056
	5 p. m.	29	5	12	2	1	5	S. W.	3	fair	
H. at a med.		29	6	10	5	1	9	Total Depth			
Gr. Height		30	3	12	2	2	6				
L. Height		28	6	8	6	1	4				

M A R C H 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29 7	10 7	1 8	S.	1 Fair	
	5 p. m.	29 7	11 7	1 6	S. E.	2 fair	
2	9 a. m.	29 6	10 7	1 7	S. b. E.	1 cloudy	
	5 p. m.	29 6	11 4	2 0	S. E.	1 fair	
3	9 a. m.	29 6	11 5	2 1	S. W.	1 cloudy	
	5 p. m.	29 6	11 9	1 8	S. W.	1 fair	
4	9 a. m.	29 5	12 1	1 9	S.	2 cloudy	
	6 p. m.	29 4	11 5	1 8	S.	1 cloudy	
5	9 a. m.	29 5	11 2	1 8	S. W.	1 Rain	
	5 p. m.	29 4	11 6	1 6	S. W.	1 cloudy	
6	9 a. m.	29 1	12 3	2 0	S. W.	3 cloudy	0,195
	4 p. m.	29 2	12 3	1 7	S. W.	3 fair	
7	9 a. m.	29 2	11 6	1 7	W.	3 fair	
	5 p. m.	29 4	11 3	1 7	W. b. N.	3 fair	
8	9 a. m.	29 7	9 6	1 8	W. b. N.	2 fair	0,055
	5 p. m.	29 7	10 5	1 6	W. b. N.	2 cloudy	
9	9 a. m.	29 6	11 6	1 9	W.	2 cloudy	0,025
	5 p. m.	29 6	10 8	1 6	W.	2 cloudy	
10	9 a. m.	29 7	9 9	2 0	W. b. N.	2 fair	0,048
	5 p. m.	29 8	10 7	1 5	N. W.	2 fair	
11	9 a. m.	29 8	9 9	1 8	S. E.	2 fair	0,036
	6 p. m.	29 6	11 1	1 9	S.	2 cloudy	
12	9 a. m.	29 6	10 8	1 8	S. W.	3 Rain	0,095
	5 p. m.	29 7	10 7	1 6	W.	3 fair	
13	9 a. m.	29 5	9 8	1 7	S. E.	2 Fog	
	5 p. m.	29 3	10 6	1 9	S. E.	1 Rain	
14	9 a. m.	29 6	9 5	2 0	S. b. E.	0 fair	0,172
	5 p. m.	29 5	11 5	1 7	S. E.	0 cloudy	
15	9 a. m.	29 4	10 4	2 0	W.	3 cloudy	0,055
	5 p. m.	29 6	11 3	1 4	W. b. N.	2 fair	
16	9 a. m.	29 7	11 3	1 8	S. b. W.	2 cloudy	0,026
	6 p. m.	29 5	11 5	1 6	S. W.	4 cloudy	

MARCH 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain.
17	9 a. m.	29 8	9 6	1 8	S. W. 3	Fair	0,707
	5 p. m.	29 8	10 8	1 3	W. b. S. 4	cloudy	0,034
18	9 a. m.	29 5	10 6	1 9	S. b. W. 1	cloudy	0,195
	6 p. m.	29 4	11 3	1 9	S. b. W. 1	cloudy	
19	9 a. m.	29 4	10 8	1 9	S. b. E. 0	fair	0,075
	5 p. m.	29 4	11 0	1 4	S. W. 1	fair	
20	9 a. m.	29 2	11 2	1 8	S. E. 1	Rain	0,113
	6 p. m.	29 1	12 5	1 9	S. b. W. 1	cloudy	
21	9 a. m.	29 1	11 5	1 8	S. W. 1	fair	0,093
	5 p. m.	29 4	11 0	1 7	W. 2	fair	
22	9 a. m.	29 5	11 2	0 0	S. W. 2	fair	0,204
	5 p. m.	29 5	12 5	1 4	S. W. 3	cloudy	
23	9 a. m.	29 4	11 8	1 7	S. W. 4	variable	0,265
	6 p. m.	29 4	10 7	1 5	S. W. 4	Rain	
24	9 a. m.	29 6	10 8	1 7	S. W. 3	fair	
	5 p. m.	29 6	11 4	1 4	S. W. 2	cloudy	
25	9 a. m.	29 6	10 6	1 7	S. W. 2	fair	
	5 p. m.	29 6	11 5	1 3	W. b. S. 1	fair	
26	9 a. m.	29 3	11 3	1 7	S. W. 2	cloudy	0,210
	4 p. m.	29 1	11 4	1 8	S. W. 1	Rain	
27	9 a. m.	29 4	11 3	1 6	N. W. 2	fair	0,034
	6 p. m.	29 5	11 4	1 4	N. W. 2	fair	
28	9 a. m.	29 7	9 6	1 6	N. W. 1	fair	
	6 p. m.	29 6	11 0	1 5	W. 1	cloudy	
29	9 a. m.	29 5	11 2	1 5	W. b. N. 3	fair	0,044
	5 p. m.	29 5	11 4	1 4	W. b. N. 3	fair	
30	9 a. m.	29 7	11 2	1 5	W. b. N. 2	fair	0,085
	5 p. m.	29 7	12 3	1 7	S. W. 3	cloudy	
31	9 a. m.	29 8	12 4	1 1	W. b. N. 3	cloudy	0,063
	5 p. m.	29 9	12 4	1 7	W. b. N. 2	fair	
H. at a m.		29 5	11 1	1 7	Total Depth 2,122		
Gr. Height		29 9	12 5	2 1			
L. Height		29 1	9 5	1 3			

APRIL 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29	9 12	3 2	0 S. W.	2 cloudy	
	6 p. m.	29	9 12	8 1	7 S. W.	3 cloudy	
2	9 a. m.	29	9 12	2 1	9 S. W.	3 fair	0,125
	4 p. m.	30	0 13	2 1	8 W.	2 cloudy	
3	9 a. m.	30	0 12	4 1	9 W.	2 cloudy	
	5 p. m.	30	0 12	6 1	7 W.	cloudy	
4	9 a. m.	29	9 12	3 2	0 W.	2 fair	
	4 p. m.	29	9 13	7 1	5 W.	2 fair	
5	9 a. m.	30	0 11	3 1	7 W.	2 fair	0,034
	5 p. m.	30	0 12	4 1	3 N. E.	2 fair	
6	9 a. m.	29	8 13	3 1	5 S. E.	0 cloudy	
	5 p. m.	29	6 13	1 1	6 S. W.	2 cloudy	
7	9 a. m.	29	6 10	9 1	5 W.	2 fair	
	6 p. m.	29	6 11	1 1	7 W.	fair	
8	9 a. m.	29	6 11	5 1	8 S. W.	2 cloudy	
	4 p. m.	29	5 11	7 1	5 W. b. N.	2 fair	
9	9 a. m.	29	5 10	5 1	6 W. b. N.	3 fair	
	4 p. m.	29	6 11	9 1	2 N. W.	3 fair	
10	9 a. m.	29	8 12	1 2	0 W. b. S.	3 cloudy	
	5 p. m.	29	8 12	4 1	5 W.	3 cloudy	
11	9 a. m.	29	9 11	4 1	6 W.	2 fair	
	6 p. m.	30	0 11	6 1	4 W.	4 variable	
12	9 a. m.	30	0 11	8 1	5 W. b. S.	2 cloudy	
	5 p. m.	30	0 12	7 1	5 S. W.	3 cloudy	
13	9 a. m.	30	1 13	2 1	9 W.	2 fair	0,055
	5 p. m.	30	2 13	7 1	5 W. b. S.	2 fair	
14	9 a. m.	30	2 12	7 1	9 W. b. S.	1 fair	
	5 p. m.	30	1 14	7 1	4 S. b. E.	1 fair	
15	9 a. m.	30	0 12	5 1	8 S. E.	1 fair	
	5 p. m.	29	9 14	0 1	3 S. E.	1 fair	
16	9 a. m.	29	9 12	3 1	8 S. E.	1 fair	
	5 p. m.	29	9 13	4 1	3 E.	0 fair	

A P R I L 1734.

D.	Hour.	Baro.		Ther.		Hyg.		Wind.		Weather.	Rain.
		In.	D.	In.	D.	I.	D.	Dir.	For.		
											0,214
17	9 a. m.	29	9	11	7	1	9	E. b. N.	2	Fair	
	5 p. m.	29	9	11	8	1	6	N. E.	2	fair	
18	9 a. m.	29	7	10	7	2	4	E.	3	cloudy	0,137
	4 p. m.	29	8	11	5	1	8	E.	2	cloudy	
19	9 a. m.	30	0	11	5	1	9	E.	2	fair	0,204
	6 p. m.	30	0	11	2	1	8	E.	2	cloudy	
20	9 a. m.	30	0	11	5	2	6	E.	2	cloudy	0,055
	7 p. m.	30	0	11	1	2	0	E.	2	fair	
21	9 a. m.	30	0	11	5	1	6	E.	1	fair	
	6 p. m.	29	9	12	6	1	4	E.	1	fair	
22	9 a. m.	29	9	9	9	1	8	N. E.	2	Cloudy	0,045
	6 p. m.	29	9	9	4	2	1	E.	1	Rain	
23	9 a. m.	29	8	11	3	2	0	E.	1	cloudy	
	6 p. m.	29	8	11	4	1	8	E.	2	fair	
24	9 a. m.	29	7	11	4	2	0	S. E.	2	cloudy	
	6 p. m.	29	6	11	6	2	1	S. E.	2	cloudy	
25	9 a. m.	29	5	12	7	2	3	S. E.	1	fair	
	6 p. m.	29	6	13	0	1	6	W.	1	cloudy	
26	9 a. m.	29	5	13	5	1	6	S. W.	2	fair	0,056
	6 p. m.	29	5	13	1	1	4	W.	2	fair	
27	9 a. m.	29	5	12	6	1	6	S. W.	2	fair	0,084
	5 p. m.	29	5	13	0	1	6	W.	1	cloudy	
28	9 a. m.	29	5	12	4	1	6	W.	2	fair	0,095
	6 p. m.	29	5	13	5	1	3	S. W.	2	fair	
29	9 a. m.	29	5	13	5	1	3	S. W.	2	fair	0,116
	6 p. m.	29	4	13	6	1	4	S. W.	1	Rain	
30	9 a. m.	29	4	12	6	1	4	S. W.	2	fair	
	5 p. m.	29	4	12	4	1	4	S. W.	2	cloudy	
H. at a med.		29	8	12	2	1	7	Total Depth 1,006			
Gr. Height		30	2	14	7	2	6				
L. Height		29	4	9	4	1	2				

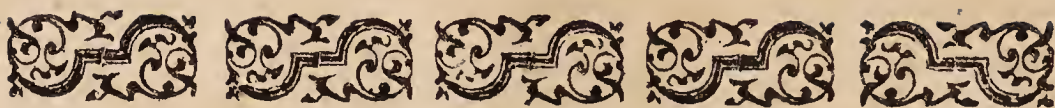
M A Y 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain. In. D.
1	9 a. m.	29	412	21	3 S. W.	2 Cloudy	
	5 p. m.	29	412	01	5 S. W.	2 Rain	
2	9 a. m.	29	79	81	7 N. E.	2 fair	
	5 p. m.	29	710	81	4 N. E.	2 fair	0,066
3	9 a. m.	29	810	41	7 N.	2 cloudy	
	6 p. m.	29	811	61	2 N. b. W.	2 fair	
4	9 a. m.	29	811	01	4 N. W.	2 fair	
	5 p. m.	29	912	31	0 N. W.	2 fair	
5	9 a. m.	30	011	21	2 W.	1 fair	0,057
	5 p. m.	29	912	61	6 W.	2 cloudy	
6	9 a. m.	29	711	91	5 W.	2 cloudy	
	7 p. m.	29	811	21	5 W.	1 cloudy	
7	9 a. m.	29	711	41	5 W.	1 cloudy	
	5 p. m.	29	610	81	7 N. E.	1 cloudy	
8	9 a. m.	29	712	01	6 E.	2 fair	0,127
	5 p. m.	29	813	11	3 E.	2 fair	
9	9 a. m.	30	011	81	4 N. E.	2 fair	0,055
	5 p. m.	30	112	71	6 N. E.	2 fair	
10	9 a. m.	30	012	01	5 W. b. N.	3 cloudy	
	5 p. m.	29	912	81	3 N. W.	3 fair	
11	9 a. m.	29	712	21	5 W.	4 cloudy	
	7 p. m.	29	412	41	5 W.	3 cloudy	
12	9 a. m.	29	411	51	4 N. W.	3 fair	
	5 p. m.	29	312	61	0 N. W.	3 cloudy	
13	9 a. m.	29	411	01	3 N. W.	3 fair	
	5 p. m.	29	411	91	2 S.	1 Hail	
14	9 a. m.	29	411	01	4 E.	2 fair	0,185
	5 p. m.	29	411	31	3 E.	2 fair	
15	9 a. m.	29	510	61	4 N. W.	1 fair	0,205
	7 p. m.	29	511	71	3 N.	1 cloudy	
16	9 a. m.	29	611	91	5 E. b. S.	1 cloudy	0,113
	7 p. m.	29	611	91	5 E.	1 Rain	

0,808

M A Y 1734.

D.	Hour.	Baro. In. D.	Ther. In. D.	Hyg. I. D.	Wind. Dir. For.	Weather.	Rain.
							0,808
17	9 a. m.	29 6	11 2	1 3	N. W. 1	Fair	0,130
	6 p. m.	29 6	12 6	1 2	E. 1	fair	
18	9 a. m.	29 5	12 6	1 4	N. E. 1	fair	
	6 p. m.	29 5	12 2	1 4	S. W. 2	fair	
19	9 a. m.	29 5	11 8	1 3	S. W. 2	fair	0,245
	6 p. m.	29 6	11 9	1 2	S. W. 1	fair	
20	9 a. m.	29 8	12 3	1 7	W. 2	cloudy	0,070
	6 p. m.	29 8	13 0	1 4	W. 2	cloudy	
21	9 a. m.	29 8	13 9	1 4	S. 1	fair	0,120
	6 p. m.	29 6	12 6	1 7	S. W. 2	cloudy	
22	9 a. m.	29 4	13 1	1 7	S. W. 1	cloudy	0,398
	7 p. m.	29 4	13 1	1 4	S. W. 1	cloudy	
23	9 a. m.	29 6	12 2	1 5	W. 2	fair	0,127
	7 p. m.	29 7	12 5	1 3	W. 2	fair	
24	9 a. m.	29 8	13 2	1 5	W. 1	cloudy	0,088
	6 p. m.	29 8	13 7	1 3	E. 1	fair	
25	9 a. m.	29 8	12 8	1 5	E. 2	fair	0,034
	8 p. m.	29 7	11 9	1 6	E. 2	cloudy	
26	9 a. m.	29 6	11 7	2 0	N. E. 2	cloudy	
	7 p. m.	29 7	11 7	2 1	N. E. 2	cloudy	
27	9 a. m.	29 7	12 0	1 8	N. E. 1	fair	
	6 p. m.	29 7	13 0	1 6	E. 1	fair	
28	9 a. m.	29 7	13 6	2 0	N. E. 1	fair	0,155
	7 p. m.	29 7	13 3	1 3	S. E. 1	cloudy	
29	9 a. m.	29 6	12 7	1 2	E. 1	cloudy	0,085
	6 p. m.	29 6	12 2	2 2	E. 1	cloudy	
30	9 a. m.	29 5	12 2	3 5	E. b. N. 2	cloudy	0,840
	5 p. m.	29 5	13 0	2 6	E. b. N. 2	cloudy	
31	9 a. m.	29 5	12 3	2 4	N. E. 3	Rain	0,213
	5 p. m.	29 6	11 8	3 3	N. E. 3	Rain	
H. at a med.		29 8	12 1	1 5	Total Depth		3,313
Gr. Height		30 1	13 9	3 5			
L. Height		29 3	9 8	1 0			



II. *An Account of the DISEASES that were most frequent last Year in Edinburgh.*

IN JUNE 1733, several Inhabitants of *Edinburgh* were seized with *Tertian Agues*, and others laboured under slight Fevers, with Pain of the Head, and flying Pains through the Body, the Sick having short Remissions of the Fever, and partial Sweatings. At the same Time *Scarlet Fevers* and sore Throats were frequent in several Parts of the Country near the City.

In JULY many complained of *Angina*, Coughs, Hoarseness, and other Effects of what they call *Summer Colds*, and Children were attacked with the *Scarlet-fever* and *Angina*, which became very epidemick in the two succeeding Months, was less frequent and milder in *October*; but continued all the Winter and Spring. This Disease began commonly with a quick Pulse, Heat, Thirst, Headach, and a Pain in the Throat, where frequently a Swelling of the *Amygdalæ* was observed. Many had a Vomiting and *Diarrhæa* at the first Attack of this Disease, without any remarkable

able Change on the other Symptoms. After a Day or two, the Face, or Extremities, and sometimes the whole Body swelled, the Skin being red, with a watery Clearness shining through it. Frequently the Swelling and Redness proceeded gradually from one part to another. It was remarked, that such Patients who had undergone the *Scarlet-fever* any Time of their Lives before, took at this Time the Fever and *Angina*, without the Scarlet Eruption, but all who laboured under the *Scarlet-fever* had the *Angina* also.

Many who were neglected in the Beginning of this Disease, were suffocated by the *Anginae*. Few died who were timely and plentifully bled, which weakned the Fever, relieved the Throat, and was the only Medicine that removed the Vomiting and *Diarrhæa*. After the Pulse was brought down with the Loss of Blood, Vesicatories were of Use, and the Cure was afterwards hastned and compleated by purging the Patients with aperient laxative Ptizans.

In the Account of epidemical Diseases in *Vol. II.* we mentioned the *Small-pox* having attacked some Children through all the Spring of 1733, the Numbers increasing in *May*, which they continued to do in *June July* and *AUGUST*, but were then generally

rally of the distinct mild kind. As they became more frequent in SEPTEMBER, there were more of them confluent, and the Number of Patients increased all OCTOBER, after which they raged most violently, few Families escaping them, till FEBRUARY, when they decreased, and gradually went off in MARCH. The pocky Pimples generally began to appear the third Day from the Sickning, and yet were not always either confluent or dangerous. Very few had any purple Spots with the *Small-pox*; and of those who recovered of the confluent kind, fewer had Tumors or Ulcers than at other Times.

The cool Regimen was generally followed; and when the Fever was high in the Beginning, with the Head or Breathing much affected, the Patients were commonly blooded and vomited; and, in the confluent kind, it was necessary and proved useful to repeat the Bleeding about the Height of the Disease, and some time after. From the first Attack of the Fever, till the *Small-pox* were all out, many order'd *Pediluvia* of warm Water once or twice a Day, which seemed in many Cases to relieve the Head considerably, and to bring a greater Number of Pimples to the lower Extremities. When the Patients were co-

stive,

stive, diluent cooling Clysters were injected. *Syrup* of white Poppies was generally given at Night to procure Sleep. In some who had bloody Stools and Urine, the *Spirit of Vitriol*, mixed in pretty large Quantities with the Drink of the Sick, did very remarkable Service, these threatening Symptoms disappearing in a little Time after they began to take such acidulated Liquors. *Vesicatories* assisted the Eruption when the Pulse was low, and often were of Service in removing Raving, Startings of the Nerves, Convulsions and difficult laborious Breathing; and some who had a bad confluent *Small-pox*, seem'd to have the dangerous Symptoms at the Blackening prevented, by applying Vesicatories a Day before the Blackening began, and by keeping up a Suppuration in the blister'd Parts for some Days. Gentle Emeticks were also advantageously given, when the Stomach or Lungs appeared to be overcharged with *Mucus*. When the *Small-pox* were empty, or had only a little watery Matter in them, and the Swellings began to fall suddenly on the 9th or 10th Day, Purgatives were given to some with good Success.

Though Bleeding in the Beginning of the *Small-pox* evidently gave Relief in a great many

many Cases, yet it could not well be judged whether the taking Blood before the variolous Fever began, or after the Symptoms appeared, had any Effect in determining the Nature or Number of the *Small-pox*; for many who had been prepared by Bleeding, Purging, Issues, and low cooling Diet, had a very bad confluent *Small-pox*; and others who had also been treated in that Manner, and a great Number who had used no such Precautions, took the mild kind. Some who had undergone Courses of *Mercury*, and who had been afterwards kept for a considerable Time to the constant Use of *Æthiops Mineral*, were seized with the confluent *Small-pox* and died.

During the Harvest Months of 1733, *Dysenteries* were frequent and mortal in *Fife*, especially on the Coast of the Frith of *Forth*.

IN MARCH and APRIL 1734, *Tertian Agues* became frequent in *Edinburgh*, and were very irregular; but repeated Vomits either carried them off, or made them easily yield to the Bark. At the same Time many Children in the neighbouring Villages were seized with a very sharp Fever, and high laborious Breathing, which soon killed them, unless they were timely relieved by fre-

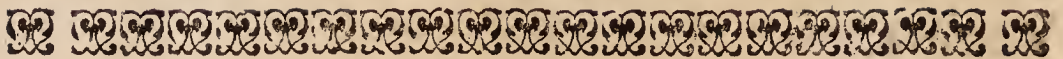
frequent and plentiful Bleeding, and gentle Vomits.



III. *An Extract from the publick Register of Burials in Edinburgh.*

1733.	Men.	Women.	Child.	Still-born.	Sum.
June - -	19	29	40	4	92
July - -	17	19	41	2	79
August - -	20	26	63	4	113
September	13	21	65	3	102
October -	15	26	106	6	153
November	19	27	144	8	198
December	21	27	116	4	168
1734.					
January	26	46	80	3	155
February	22	23	57	4	106
March -	28	27	66	4	125
April - -	25	31	50	3	109
May - -	31	46	41	9	127
Total	256	348	869	54	1527

IV. *The*



IV. *The Effects of the Conessi Bark by —*

Gentlemen,

NOT having Allowance from my Friend, who wrote me the inclosed Letter, to publish his Name, I cannot take upon me to communicate it; but can assure you, his Integrity, good Sense, and Knowledge are such as may give entire Credit to his Information; and lately I cured an obstinate Dysentery of three Months standing, which had yielded nothing to a great Variety of other Medicines, by giving the Conessi Bark in the Form prescribed by him. I am

Your most humble Servant,

ALEX^r. MONRO.

THE Tree of which I gave you some of the Bark as a Specifick in *Diarrhæas*, grows on the *Cormandel Coast* in the *East-Indies*, where it is called *Conessi*, and is not unlike the *Cadogapala* of the *Hortus Malabaricus*. The *Conessi-seca*, or *Conessi-bark* of the small young Branches of the Tree which has least Moss, or

external insipid Scurf on it, is to be chosen, and all that Scurf is to be scraped off.

The clean Bark being pounded into a very fine Powder, is made into an Electuary, with Syrup of Oranges, and taken to the Quantity of half a Drachm, or more, four Times a Day, for three or four Days. The first Day it increases the Number and Quantity of the Stools, but without increasing the Gripes. The second Day the Bark is taken, the Colour of the Stools is mended; and on the third or fourth Day, their Consistence generally comes near to a natural State, when it succeeds at all.

In recent *Diarrhææ*, arising from Irregularities in Diet, without a Fever, this Medicine seldom fails to make a Cure, if a Vomit of *Ipecacuanna* is given immediately before the Patient begins the Use of the Bark. The same Management also is attended commonly with Success in Persons of a lax Habit of Body, who are troubled with an habitual *Diarrhæa* in moist rainy Weather, a remarkable Itching in the Skin being felt on the third or fourth Day. To such Patients especially, the Electuary ought to be given Morning and Evening, for some Time after they are seemingly cured. Their Drink should be Water wherein Rice hath been boiled, and some-

times Emulsions of the cold Seeds, with *Sal prunell.* are necessary.

If there is a Fever with the Looseness, that must be removed by Bloodings and cool Emulsions, or *Decoct. alb.* with *Sal prunell.* before the *Conessi Bark* is given.

Sometimes when the Cause of a *Diarrhæa*, stop'd by this Medicine, lies beyond the intestinal Canal, the Patient, in a few Days after, complains of a Pain in the right *Hypochonder*, or in the right Shoulder, or over the Stomach towards the left Side, causing often a dull Sense of Pain, near or above the left Clavicle, with a feverish Pulse. As soon as these Symptoms appear, the Patient must be blooded, and his Blood will be fizy, or with a tough yellowish Crust on the Top, when it has coagulated. The Quantity of Blood to be taken away, and the repeating the Venæsection, must be determined by the Patient's Strength, the Degree of Fever, and Sharpness of his Pain. In such Cases however the Bleeding seldom removes the Pain entirely; but after the Fever is brought sufficiently down by the Loss of Blood, I have seldom missed to complete the Cure, by giving *sweet Mercury* or rather *Calomel*, for some Days, in small Quantities, as an Alterative.

I ought to observe, That the Bark should be

be fresh-powdered, and the Electuary new-made every Day or second Day, otherwise the Bark loses its austere, but grateful Bitterness on the Palate, and its proper Effects on the Intestines.



V. *A Gangrene stopped by the Cortex Peruvianus; by Mr. SAMUEL GOOLDEN Surgeon at Bridgnorth in Shropshire.*

I Cannot help not only expressing my own Pleasure and Satisfaction, but must also congratulate every Professor of Physick and Surgery, upon the laudable Attempt of your Society, in their Endeavours to improve medical Knowledge, by their annual Essays and Observations: A Work which I have long desired, and thought wanting in our Dominions, and do think it a Duty incumbent on every Professor of Physick, or any Branch of it (in these Countries especially) to communicate to them any remarkable Observation that may fall under their Cognizance, and may tend to promote so useful a Design.

Since that valuable Medicine the *Cortex Peruvianus* has been so successfully given in Mortifications from an internal Cause,

by Mr. *Rushworth*, Mr. *Amyand*, Mr. *Bradley*, Mr. *Douglas* and Mr. *Skipton*; a remarkable Instance of its Success in a more than parallel Case, I had lately the Pleasure of observing in a Patient of mine. I have not the Vanity to think that what I can say will add any thing to its Credit; but it may be a Means to make its Virtues in such direful Disorders more generally known, and help to confirm what the above Gentlemen, and especially Mr. *Douglas* and Mr. *Skipton* have so ingeniously said of it.

January 8. 1733-4.

Samuel Lewis, aged 76. of a pale Complexion, and cholerick Constitution; a lusty, and seemingly a very healthy Man, having but little Sickness from his Youth, shewed me an Inflammation of his left Leg, extending from an Issue he had below his Knee, down to his Ankle, and all round his Leg, partaking of an *Erysipelas* and *Oedema*. I threw out the Pea from his Issue, and endeavoured by discutient Fomentations, Embrocations, and Cataplasms, with Bleeding and lenient Purges to mitigate the Inflammation; but to no Purpose; for I found it tending very fast to a Gangrene. His Leg from an intense red Colour, turned livid, black Blisters arose, &c. I would
have

have scarified it, but was not permitted.

On the 13. Day, the Tumor was sunk, his Leg black and dry, his Pulse quick, with frequent Intermissions, his Countenance wild, his Tongue hard, parched and dry. He would not permit the necessary Incisions to be made. With the Consent of Dr. *Anthony Weaver*, a Gentleman of great Charity, Humanity and Learning, I prepared eight of the following Draughts,

R. Cort. Peruv. opt. pulv. Drach. sem. Aq.

Cerasor. nigr. Unc. i. sem. Syrup. Croci

Unc. sem. M. One of which I gave him about Noon, and ordered that he should continue to take one every four Hours.

14. About ten this Morning, by which Time he had taken three Drachms of the Bark, I found his Tongue moist, his Countenance not so wild; and examining his Leg, found it impostsomated, from a little below the superior Tubercle of the *Tibia* down to the small of his Leg, a little above which I saw a small Aperture, with a little Matter ouzing from it. I told him he stood a very fair Chance for his Life, if he would submit to the suitable Means. With his Allowance, I immediately entred the Probe-Point of my Scissars at the Aperture, and cut upwards as far as it was hollow; then turned them, and cut downwards as far as

the Cavity ran, and discharged between three and four Ounces of a well digested Pus, and after fomenting very well with a Decoction of the warm Plants in a strong Lixivium of Woodashes, *Sal Ammon. com.* & *Spir. Vin. Camphor.* (which I had used from the Time I suspected it would mortify) I dressed the Incision with *Ung. Basilic. Liniment. Arcaei a a. part. æq.* spread upon a Dossil dipt in hot *Ol. Terebinth.* with a Cataplasm of Oat Meal, *Flor. Centaur. Chamæmel. a a. p. æ.* with the Fomentation; and *Ol. Chamæmel.* over all. He found an agreeable Warmth about his Leg after the Dressings were applied.

15. I found him very chearful, and discovered a large Sinus betwixt the *Solæus* and *Gastrocnemius intern.* I laid it open, and discharged about the same Quantity of well-digested Matter as yesterday. There was a very large Slough in the former Incision, which I cut off, and dressed as before.

16. He had been very restless all Night, his Pulse irregular, his Tongue rough and dry, with Flushings in his Cheeks. Inquiring if he had taken his Draughts regularly, I was told he had not, through the Attendant's Drowsiness. After reprimanding them for that Neglect, and cautioning him

him about it for the future, I opened his Leg, and found the Discharge large, a fungous Flesh rising in the first Incision, which I sprinkled with *præcipit. rubr.* and dressed as before; and by reason he had not a Stool since the 14th, I ordered him a common Clyster, which brought away some hardened Excrements. At Night his Heat and Flushings were not so great, and his Tongue was moister.

18. Being wearied of his Draughts, ordered thus,

℞. *Cort. Peruv. opt. pulv. Unc. sem. Confec. Alkerm. Unc. i. M. divid. in Bol. viii. cap. unam quarta quaque hora superbibend. Cochlear. iii. julap. sequentis.*

℞. *Aq. Lact. Cerasor. nigr. a. Unc. iv. Rut. Unc. sem. epidem. Unc. ii. Tinct. croc. in aq. theriac. fact. unc. i. Confec. Alkerm. Unc. ii. syrup. Cariophyll. Unc. ii. M.*

I observed Matter lodged in the *Gastrocnem. intern.* almost to the Back of the Leg; I opened it in the most depending Part, but had not the Discharge I expected.

21. Compresses and Bandage were applied to unite that Cavity, and prevent the Matter from lodging in it.

22. A *Sinus* running towards the Small of his Leg opened.

23. He complained of a Pain in his Side, and had a restless Night : I dressed the Ulcers only with dry Lint ; the Cavity above-mentioned inclined to unite.

24. He was very much dejected, but I could not apprehend the Reason of it, every thing appeared in good Order.

25. He shewed me a Swelling in his Groin, with great Hardness and Inflammation down the fore and inside of his left Thigh, extending to a pretty large and insensible Tumor, a little above his Knee, which he found gradually to increase since the 15th Instant, but did not speak of it before, lest he should (as he expressed it) be cut there. I applied an emollient Plaister over it, was apprehensive he would have a very large Abscess, which would exhaust him. There was very little Discharge from his Leg.

30. To this Day his Fever increased with an irregular Pulse, great Drought, dry Tongue, &c. notwithstanding he continued the Use of the Draught or *Bolus* as before ; very little Discharge from his Leg ; the Ulcer appearing livid. I fomented well, and applied the warm Digestive as above. The Swelling in his Groin very much increased ; the Inflammation decreasing, I felt Matter to fluctuate, but deep ; the Tumor

not very painful. Not having a Stool for several Days past, I gave him a lenient Purge, by which he had a very large Stool of black and very fetid Excrements.

31. The hard insensible Tumor above his Knee of a livid Colour, and that in his Groin rising towards a Point near the *Inguen*, inclining to the Inside.

1, 2. *February*, Instead of Matter, there was a Discharge of clotted Blood from his Leg; I dressed with the warm Digestive.

3. The *Pus* was laudable, the Tumor in his Groin considerably raised; he took a lenient Purge, which gave him one Stool, not having one since the 30th *ult*.

11. To this Day his Fever continued, but not in any great Degree, and his Pulse irregular; a white Pustule appeared upon the most prominent Part of the large Tumor in the *Inguen*, which I cut, and then entering the Point of my Probe-Scissars, cut about an Inch in length near his Groin; well digested Matter gushed out, as from a Cock, and in as full a Stream, sometimes streaked with Blood. I took thence at least *lib. iii*. His Leg begins to cicatrize.

12. A large Discharge about the Bed from the last Incision, and a large Quantity of Matter that fell below the Orifice, yet in the Cavity on the inside of the Thigh. I
ap.

applied a Caustick on the lowest Part, and discharged thence about *lib. sem.* I also opened that Tumor near his Knee, and discharged *Unc. i.* of well digested *Pus.*

19. I opened another *Sinus* on the inside of his Leg, and discharged thence only several Clots of Blood. From this Time the Discharge from his Thigh gradually lessened; that very large *Sinus* united, by means of Compress and Bandage; his Fever left him, and he did not use his Medicine since the 14th instant, in which Time in Draughts and Boluses, he had taken between *Unc. x.* and *Unc. xii.* of the *Cortex*, which being continued so long and regularly, I believe assisted Nature to expel her Enemy in that very large Abscess in his Thigh, which otherwise might, notwithstanding the Mortification was stopt in his Leg, have seized it again, or have fallen upon some more noble Part, and occasioned his Death; after which I made him a Decoction of the most agreeable Bitters, by which Means he recovered a good Appetite; and in a short Time was able, with a little Assistance, to walk down Stairs, and any where else in the House with a Staff only; and, on the 25th of *March*, he walked to my House to be dressed, which is near a Quarter of a Mile; and about a Week afterwards went

to

to his Work as usual (which is mending Shoes) his Leg giving him very little Disturbance: In the Day it swells considerably, but when he rises in the Morning is of its natural Size, for which I ordered a laced Stocking. His Thigh is strong and firmly cicatrized, as also is his Leg; and the Man enjoys good Health, and is every way as fit for his Work as he was before his Illness.



VI. *A Mortification cured by the Peruvian Bark; by Mr. JOHN PAISLEY Surgeon in Glasgow.*

Gentlemen,

THE good Effects of your generous Concern for the Welfare of Mankind, are now conspicuous in the many useful Observations and Essays that have been communicated to the Publick in your Collections, which, without this Opportunity, would probably never have seen the Light. At the same time I must think we are also greatly indebted to you for the judicious Abridgement of the most considerable Improvements and Discoveries in Physick made through *Europe*, which most private Persons

sons remain entirely ignorant of, or it is very late before they are informed of them. It is owing to your *Second Volume* that the specifick Virtue of the *Cortex Peruvianus*, in curing *Mortifications*, was known early enough here to be put in Practice in the following Case.

A Surgeon of this Place, of a very bad scorbutick Habit of Body, about forty Years of Age, had a little Pimple on the middle of the Under-lip, which his Barber cut the Top from, in shaving him on *Saturday* the 9th of *February* last. The following Evening, upon going out to the cold Air, the Pimple swelled, and turned hard, with an Inflammation all round it; which increasing the *Monday* following, he applied an Antiphlogistic Fomentation with Spirit of Wine camphorated. Notwithstanding the frequent Use of these for four or five Days following, and his being twice blooded, the Inflammation, Hardness and Swelling increased considerably, extending itself to the Angles of his Mouth, and some way along the Cheeks, and all round the Chin, with great Pain and with vast Disorder through his whole Body.

On *Friday* the 15th, at Eleven at Night, a small black Spot, about the Bigness of a Herring Scale, appeared (not where the
Wound

Wound was, but) on the middle of the red Part of the Lip, which spread so fast that by Eleven next Forenoon, it covered near one half of his Lip, that then began to stand out very much; when a Consultation of almost all the Physicians and Surgeons in Town was called, who advised the Continuation of the Fomentation and Spirits as before, and a Decoction of the Woods. For two or three Hours the Mortification continued to spread, till it had covered almost his whole Lip, reaching inwards and downwards to the Gums, the Hardness and Swelling of the neighbouring Parts increasing. Upon this he was advised to try the Powder of the *Cortex Peruvianus*, half a Drachm for a Dose. He took the first Dose betwixt Three and Four a-clock after Noon, and his Lip was dressed at Ten at Night, when the Mortification did not appear to be increasing, at least the Increase was very inconsiderable: He then took another Dose of the Bark. Towards the Morning of the 17th, his Lip was again fomented, and he took a third Dose of the *Cortex*. At Ten of the Forenoon I dressed it, and found the Mortification had made no further Progress since last Night. At Night I dressed it again, and then for the first time observed something like an Appearance of Suppuration

ration at the Place where the Wound or rather Pimple was, but none at all on the mortified Part. That Night he took another Dose of the *Cortex*, and continued to take two Doses, one in the Morning, and another in the Evening for two Weeks.

The Fomentation and Spirits being applied twice a Day, and a little Emulsion given him for Drink, without any other Medicine than the *Cortex*, the Suppuration succeeded well in the mortified Parts on the third Day after he began to take that Medicine; upon which, proper Digestives and other Dressings were applied. The Sloughs cast off very well, the Hardness and Swelling went away, and in 12 or 15 Days the Lip healed up, though with a considerable Contraction by the great Loss of Substance.

In very cold Air he still feels a Pain in his Lip: This I am apt to believe does not so much proceed from the Callus, as from his Lip pressing upon the Fore-teeth which are very rough and loose; and which it does more, especially when he attempts to speak, by the Lip being so much contracted.

I have read this Account to the Patient, and had his Approbation of my Relation of the Facts, which my Attendance on him all the Time of this Disorder gave me sufficient Opportunity to observe.

VII. Re-



VII. *Remarks on Chalybeat Waters; by*
 ALEX^r. MONRO *Professor of Anatomy in the University of Edinburgh, and*
 F. R. S.

THE ingenious Account of several *Steel-Waters* in some of our Northern Counties, given by my worthy Friend Dr. Thomson Physician at *Montrose*, [See *Art. 6.* of our *2d Vol.*] raised a Desire in me to be informed of the most remarkable Mineral Waters of that kind which are to be met with so frequently all through *Scotland*; and as my View was only to know so much of them as was necessary in Practice, I proposed to discover, by my Friends and Correspondents, what their real or comparative Strength was, and how well they would carry and preserve without losing their Vertues, whereby Physicians might judge which of them was most proper in the various Diseases and Circumstances of Patients, and which must be drunk at the Fountain, or would serve as well when kept.

It was necessary in such an Enquiry that there should be some general Method by which

which all the Trials should be made, otherwise there would be an insuperable Difficulty in making the Comparison of them. The Writers on this Subject have contented themselves with telling us, that such Water strike a red, purple, violet, or black Colour, when Galls or such other Astringents are mixed with them, and that this Change of Colour is a sure Mark of a Chalybeat Water; and some have said, that the deepest Colour shews the greater Proportion of Steel. To satisfy my self of the Truth of this, I dissolved artificial *Sal Martis* in a small Quantity of Fountain Water, and then dropping more or fewer Gutts of this Solution into a given Quantity of common Water, I found that by the Mixture of the Tincture of Galls, I could form all the different Colours mentioned, the larger Quantity of the Solution always requiring the greater Number of Drops of the Tincture to bring it to all the Colour it would take, and that being as constantly deeper than the others, where fewer Drops of each had been employed. If Words could express the numerous Degrees of Colours between the pale-red and the black, the lightest and deepest of these mentioned, the simple Experiment of bringing *Steel-Waters* up to the deepest Colour they could strike with
Galls,

Galls, might be sufficient to determine the different Proportions of Steel in each; but as that Variety of Colours cannot be expressed in Words, and I wished to come to the Knowledge of nearly the real Quantity of Steel contained in any given Quantity of each Water, there was a Necessity of having some general Standard to which all might be brought. To obtain this, I observed the Quantity of Steel employed in preparing *Sal Martis*, saw how much Salt was got, what the *Residuum* of earthy Parts was, made a small Allowance for some evaporating during the Effervescence of the *Limatura Martis* with the *Oil of Vitriol*, and concluded that the Proportion of Steel in the artificial Salt or *Vitriol* of Iron, was very little more than a third Part. Next, I dissolved a certain Quantity of this *Sal Martis* in Fountain Water, weighed the Powder that precipitated from it, weighed the whole Solution, and then putting some of it into a small Glass, I dropped it *guttatim*, into another Glass counterpoised exactly in a Scale, till I saw how many Drops of this Liquor weighed two Drachms; after which, by common Arithmetick, it is easy to know how much Salt, and consequently very near how much Steel is contained in any given Number of such Gutts. To

save my Friends the Trouble of making such a Solution, I prepared 20 Ounces, which contained an Ounce of the *Vitriolum Martis*, except a Scruple which was precipitated, and 142 Gutts of this Solution weighed two Drachms; therefore every such Gutt contained $\frac{1}{23}$ of a Grain of Salt, or $\frac{1}{65}$ of a Grain of Steel. The Difference of the Bulk of the Drops let fall from different Glasses should not, you see, at this rate make a very considerable Error; but to prevent this as much as I could, I chose all the Glasses as near to the Shape, Size and Thickness of the Lips of the one I first used as I could get them.

To make a Comparison then of any *Chalybeat Water* with this Solution, into a determined Quantity of such Water, pour Drop after Drop of a strong clear Tincture of Galls, allowing a sufficient Time between each Drop for its having its full Effect, till it is observed that the Addition of more Tincture makes no Change on the Colour of the Water; and to make sure of the Number of Gutts of the Tincture that are requisite, let the Experiment be repeated several Times. Then having the same Quantity of common Water as was employed of the Mineral Water, in a Glass of the same Dimensions, Thickness and Transparency, with

with that made use of in the preceding Trials, pour into it the Number of Drops, discovered by them, of the same Tincture of Galls, and mix them well; after which in the same cautious Manner, drop in the Solution *gut-tatim*, till their Colour is the same with that of the Mineral Water. When once the Quantity of Solution equal to the Contents of the *Spaw* is known, pour a due Proportion of it into common Water; and let several People examine whether the Taste of it is not the same with what the Mineral Water has. I have thus made Fountain Water so like to several *Chalybeat* Waters, that none could distinguish them.

I prefer Tincture of Galls to their Substance for making the foregoing Experiments, because it produces its Effect much sooner and more equally than the Powder, and a less Proportion of the Virtue of the Galls can be added at once, which from an Observation communicated to me by Dr. *John Taylor* Physician here, and verified by me afterwards in several Steel Waters, and in common Water impregnated with *Sal Martis*, would seem very necessary to be regarded; for if too large a Proportion of Galls is at once poured into such Waters, for Example, if 60 or 100 Drops of a Tincture of Galls is thrown into a Water that re-

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quires

requires only 8 or 9 to bring it to its deepest Colour, it will be so far from making it strike the Colour stronger or sooner, that, for several Hours after, no Change will be observed on the Water; and at last it gradually becomes of a deep Sea-green Colour, instead of the Purple or Violet it would otherwise have turned into. It is not impossible that good *Chalybeat Waters* have been sometimes condemned as containing no such Mineral, or of being impregnated with Copper by a Mixture of too much Galls at random.

Recent Tincture of Galls is certainly preferable to that which is long kept; but I can assure you, that after I had kept such Tincture till it was covered with a thick Moss, or was mouldy, as we call it, a Top, and had a viscous thick Sediment, it still produced the common Effects on Steel-Waters.

I would propose that the Comparison above described should be made with fresh Water at the Steel-Springs in different Seasons, and should be repeated once a Week with Water that is right put up in Bottles well corked and sealed in these different Seasons, till it becomes vapid by keeping; by which the proper Seasons for bottling the Mineral Waters, and the Time each will preserve, can be much more exactly known

known than it is possible to determine by the Smell and Taste of them.

It will be also requisite to observe what time it is before the Galls strike the Colour fully after they are put in, and to remark how long this Colour remains in an open Glass; for it appears reasonable enough to think with the *French* Academist Mr. *Geofroy* (a) that more Time will be necessary to strike the Colour fully, but that it will remain longer in such Mineral Waters where the Steel is most intimately dissolved in and blended with the other Principles.

To make the Account of the *Spaws* complete, their other Contents ought to be sought after, by mixing different Substances with them, remarking the Changes they undergo in Smell, Colour, &c. by keeping, and by extracting their Salts and Earths after Evaporation.

By these means it is that I was in Hope to have furnished you with a pretty complete List of the most remarkable *Spaws* in this Country, with the comparative Strength of each, and the Time they kept; but being disappointed of several I expected, while Informations of others, I had not heard of, are often brought me, I shall reserve what

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(a) Memoires de l'Acad. des Sciences, 1724.

I have received till I can present you a more full Account, which your Publication of this Invitation will probably soon enlarge, by acquainting the Gentlemen who have the Opportunity of examining such Waters, of the common Method they should all take in their Enquiries, and to whom they may address their Discoveries. In the mean time allow me here to annex some Experiments, which Thinking on this Subject led me to make.

I had observed, as above, a strong Resemblance between our Steel Waters and common Water in which a small Quantity of *Sal Martis* had been dissolved; but the natural *Spaw* Waters, when exposed to the open Air, very soon lost their Chalybeate Taste, and would not strike a purple Colour with Galls: When exposed to Heat, their Virtues were much sooner lost, and in the closest Vessels they, in no long Time, became vapid; whereas *Sal Martis* bears Heat, and being exposed to the Air, without perceptibly losing any thing. I suspected this Difference might in part depend upon the smaller Proportion of the vitriolick Principles in the Chalybeate Waters, and some Change they might thereby undergo in the Water, and therefore having added to some Bottles of Water as much *Sal Mar-*

it is as had been found to make it of the same Taste, and to strike the same Colour with Chalybeat Waters, I corked some carefully up, others I put bad Corks into, and a third sort I left open. The Water in these last lost its Taste and Virtues in about a Fortnight, with little other Change than becoming a little muddy, and having a Saffron-coloured Powder at Bottom. The second kind kept some time longer, but had a little of a stinking Smell before it became vapid. The Water that was carefully corked and refined, kept well, but acquired a pretty strong Smell of rotten Eggs exactly like to what several *Spaws* had when kept; and when the Bottle was left open, the stinking Smell went soon off, and soon after the Chalybeat Virtues were not to be observed, and the Bottom of the Bottle was covered with the Saffron-coloured Powder, which is generally to be seen also in Bottles where natural Chalybeat Waters have been kept any Time. So far therefore the Difference between the natural and artificial *Steel Waters* seem'd only to be in the greater Volatility of the natural ones.

Several of our own Chalybeat Waters, and the two foreign ones of greatest Reputation, *Spaw* and *Piermont*, seem'd to me an Exception to the Resemblance I had

found between the diluted Solution of *Sal Martis* and the natural Steel Waters, for the Colour they strike with Galls is very faint, while their Taste and other Effects are remarkably strong. This put me on trying to find some artificial way of imitating them: For this End I mixed Filings of Iron, Oil of Vitriol, and Water in a *Florence* Bottle, which I laid on its Side, and immediately fitted another to it, in which I had put some Fountain-Water. The Fumes that rose upon the Effervescence of the Oil of Vitriol with the Steel, came over into the other Glass. After the violent Effervescence was over, I took away the Glass with the Water, which was quite limpid, but had a strong empyreumatic Smell; its Taste was pungent at first upon the Tongue, and then the acidulous Taste prevailed. When Tincture of Galls was mixed with it, it became of a red-purple but faint Colour, which held a great many Days without any observable Precipitation. Next Morning the *Empyreuma* of the remaining Water was gone, and it had a very agreeable brisk *Spaw* Taste: In less than a Day after, this also went off; a small Quantity of the Saffron-powder was fallen to the Bottom of the Glass, and the Galls had no Effect on the Water.

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On a Suspicion that this artificial Water would give evident Signs of Acidity; whereas the Solution of *Sal Martis*, and some of the *Spaws* that strike a black Colour, rather appear alkaline, by changing Syrup of Violets and Clove-july-flowers into a green Colour; I mixed it with these Syrups, without changing the one into red or heightning the Colour of the other. It is true it did not make them green, neither do the more spirituous *Spaws*.

The Success of this Experiment, which was beyond my Expectation, led me to try if I could not discover what it was that evaporated, and what was precipitated in these Waters. I suspected the *Menstruum* to fly off, and the Steel to be left behind. To know then if this Safron-coloured *Residuum* was Steel, I poured Oil of Vitriol on it, which made no remarkable Effervescence; I then added Water, and let them stand two Days, when some of the Powder seem'd to be dissolved: Upon mixing Tincture of Galls with it, the Colour did not change; but upon further Addition of Spirit of Hartshorn, a great Effervescence followed, and a sudden *Coagulum* of a deep red-purple Substance was made. This Change of Colour I at first imagined to depend on the *Residuum*, but upon mixing the

the other Ingredients without any *Residuum*, the same *Coagulum* was formed; and therefore, if the Powder precipitated from the Mineral Water, is the Particles that composed Iron, they are greatly changed. The Resemblance of the Rust of Iron to this Powder, made me try how these Experiments would hold with it, and they came out in the very same manner: Nor would Rust, or the Powder, when suspended in Water, strike any Colour with Galls, though the *crocus martis* of the Shops did.

What flies off in the Evaporation is evidently the *Menstruum*, in which the irony Particles were dissolved, which carries away some of the Principles of the Iron with it. From seeing the Effects of Acids on Iron, observing the Effects of that almost universal *Menstruum* of the Air upon this Metal, and finding Vitriol of Iron naturally formed, we have Reason to judge that the *Menstruum* of the irony Particles in chalybeate Waters, is also an Acid. And considering how much Sulphur enters into the Composition of Iron, what a strong stinking Smell, (which can only depend on Sulphur) Mineral Waters have before they turn vapid, and how much the Sulphur of Iron is destroyed, before the Iron turns into Rust, which again resembles the Powder precipitated in these

these Waters; all this would persuade us, That the *Menstruum* carries the Sulphur along with it, and leaves only the earthy Parts, with a small Proportion of Sulphur.

May not Steel-Waters be impregnated with common gross Vitriol, or with the more subtile Fumes of Iron dissolved in the natural *Menstruum*; or with both in different Proportions?

Will not the less Volatility of some chalybeat Waters, and the quicker Precipitation of their irony Particles, after the Mixture of Galls, shew the Sulphur not to be so much freed from the earthy Particles, as in others that precipitate more slowly, and are more volatile?

Will not the common Observation of Air generated in all Effervescencies, Fermentations, Putrefactions, and wherever a considerable Change is produced in the Composition of Bodies, account for the Quantity of elastick Air, observed in chalybeat Waters, in the more spirituous when recent, in others when the putrid Smell shews the Sulphur to be more disengaged?

Are not the different Kinds of Steel-Waters to be prescribed, according as there is Occasion for a subtile penetrating sulphureous Spirit to pervade the smallest Vessels, or according to the Quantity of an absorbent

bent astringent Earth, that is required to be joined with this Spirit?

Where different *Spaws* are not to be had, may not the same Water be made to answer each of these Intentions, according to its being more or less kept, or exposed to the Air or Heat?



VIII. *An Enquiry into the Mineral Principles of Montrose Water*; by ALEXANDER THOMSON M. D. *Physician at Montrose.*

AFTER all the Enquiries made into the Contents and natural Appearances of Mineral Springs in *Germany, France and England*, by Men most accomplish'd, and Means promising the best Success, the Subject seems yet much in the dark, when all Appearances are justly weighed.

Of the latest Enquirers into the *English Waters* is Dr. *Short*, and after him Dr. *Shaw* has examined the *Scarborough Water* particularly. They have entred more into the Subject than most others before them, and offered fairer at a Discovery of their Virtues from their real Principles; yet all the Learning of the first, and Accuracy of the other, have still left the Subject involv'd
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in Variety of Doubts, of which I shall only mention a few.

That *Spaws* strained through Mineral Bodies, dissolvable in Water, may not, and at Times actually do not partake of all, but only of some them, as Dr. *Short* hath observed of the *Alum* Stone, in the Cliffs of the Rock through which the *Scarborough* Water strains; and that yet the Water gives no Vestige of *Alum*, upon all his Trials.

From the same Instance of *Alum*, he hath, I think, observed something more mysterious in the Composition of mineral Waters, to wit, That in the *Congeries* of Mineral Bodies through which they flow, two of different Natures, as *Alum* and *Sulphur*, may be so involv'd, that the one apparent as *Alum*, gives, upon Trial, a Demonstration of the Presence of the other, whereof nothing appeared before; as in the Solution of the above named *Alum-Stone*, both the Sludge, or undissolved Dreg of the Stone, and also the Sediment of its Solution, give an intolerable *Foetor*, as strong as that of the *Harrigate sulphurous Well*, and, in a red hot Iron-Spoon, throws out a blue Flame, whereby *Sulphur* is known to be distinguished.

That the purple Tincture of *Steel-Spaws*
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with Galls and such like, should be owing to the Vitriol of Chalybeat Waters, and notwithstanding, what gives such Tincture should inevitably fly off less or more, or altogether, an Hour or two after drawing; or sooner by several Degrees of Heat, the highest within the boiling Degree; when nothing in Vitriol that gives such Tincture, hath been observed to fly off in that Manner.

That the medical Effects of mineral Waters in general, in Cases of the Spirits or animal Faculties affected, should be generally observed, and particularly by Dr. *Short*, to be best when drunk at the Fountain; and yet that Dr. *Shaw* should find, that the Salt of *Scarborough* Water, got by Evaporation, cheared the Spirits, and in general gives Life and fresh Powers to Nature, as much as the Water when drunk fresh at the Fountain.

That a Mineral Water should be 17 or 18 Grains a Pint heavier when carried to a small Distance, than when immediately drawn, as Dr. *Short* hath observed of *Scarborough* Water, and this should be owing to a more dilated Air, or a very subtile Mineral Spirit; and yet no Air for being more dilated is less a Body, neither does any Mineral Spirit, for being subtile, become no
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Body, and therefore not ponderous. Bodies differ from Bodies in their specifick Gravities; but no Subtilty nor Dilatation hinders every Body from gravitating: And therefore, whatever it be that evaporates from the Water, it should, by all that is known of Bodies universally, rather diminish than augment their Weight by its Absence. Nor would there be less Difficulty to conceive a Reason why the Weight of the Water thus increased in so short a Time, should increase no more a Day, a Month, a Year after. All this notwithstanding, the Doctor hath likewise observed, that the Chalybeat *Scarborough* Water weighs still heavier, the more it is freighted with this Mineral Spirit.

The general Uncertainty wherein the greatest Naturalists, as Mr. *Boyle* and Mr. *Hoffman*, have put or left us, on the Subject of Mineral Springs; and the more particular Difficulties I have now chose out from among several others, which, for Brevity I omit, wherein the two learned Physicians I have named, after their more accurate Discoveries, have left us yet involved; and the Laws of Enquiry, proposed by the latest of them, requiring an Age, or it may be Ages, rather than the Endeavours of any one, or of a few Men: These Considerations, I say, are a sufficient Caution to me

me, not to be too decisive in a Matter still so obscure.

The MONTROSE-WELL is situate in the richer Sort of our Soil; the upper Lay being of a blackish or Moss Colour; the lower, to about three Feet depth from the Surface, Lays interchanged perpendicular, one of soft Clay, the other of Sand, soft, and as it were fattish to the Touch; through which last, at about the above depth, the Springs drill out horizontal to the Surface in several Parts.

The Water, when new taken up, is of a whitish Colour, above that of ordinary Spring-Water; the Taste soft, and faintly discovering the Mineral Quality. I compared the Weight of this Water with two of the most noted of our Steel Springs, and one of fine ordinary Spring-water, in a Balance that was turned by one Grain, and could observe scarce any Difference of Weight in any of them. This Difficulty I cannot well account for.

I began my Trials on this Water with those commonly made with Steel Springs, but they did not answer; and I suspected its purgative Quality on the Drinkers might be owing to its being generally drunk very muddy, by People's thronging on it, till it was built about. A few Days after, by an Accident

dent I began to conceive it to be of a different Nature from the Steel Springs. A Phial Glass into which several Parcels of the Water had been thrown at random, with several Things, as Galls, Rose-buds, and green Tea, being broken by Accident at Night; in the Morning I perceived a white milky Substance covering the Floor where the Glass was, and about it a Scurf variegated green and other Colours, much like these of a Peacock's Tail. These led me into a Suspicion of something sulphureous in the Water.

I drop'd some Gutts of *Ol. Tart. per deliq.* into a Glass of the Water, and there presently form'd at the Bottom of the Glass a white light equable Cloud, such perfectly as appeareth ordinarily in the Urine of People in Fevers, at the Time when they have a favourable *Crisis*, or immediately after it; the one and other waving with a plain equable Surface, by inclining the Glass to and again, only that of our Water was of the purest white. As this Appearance in such Urine, gives, as I imagine, plain Notice of the morbid sulphureous Parts of the Blood now perfectly concocted, and so washed off by the Urine, as by the other Strainers of the Body; the Analogy seem'd to me natural betwixt the two Appear-

ances in the Urine, and in our Water.

To try this further, I made *Sulphur soluble cum Alkali fixo* after *Boerhaave's* Way, four Parts *Sulphur* to a fifth *Sal Tart.* This dissolv'd in Water, and *Ol. Tart.* drop'd on it, gave a Cloud, but less discernible than what appeared in our Water, which I imputed to the yellow Tincture of the Solution not reflecting the Rays fully: And accordingly a Day after the *Sulphur Solubile* having become moister by the Air it imbib'd, and turning whiter, I dissolved it again, pouring on Water till the Solution became of the Colour of our Water when new-drawn, and the *Ol. Tart.* affused gave conspicuously the same manner of Cloud with that in the mineral Water, so that the one could scarce or not at all be distinguished from the other.

The Success of these Experiments, compar'd with the above Accident, made me incline to believe that these Clouds were *Lac* of Sulphur. To make Trial of this further, I would see what a strong astringent Salt would do with the Water of our Well; I chose *Alum*, and weighing a small Piece of it, I put it whole among a Glass of the Water, and by constricting its Pores (as I imagined from the *Alum's* having lost none of its Weight when taken out of the Water,

Water) it quickly form'd a white *Coagulum*, which, by mixing some Drops of *Ol. Tart.* presently falling to the Bottom, I poured off the Water, and evaporated what remained by the Heat of the Sun, into a concrete Mass, of a soft Taste, and with nothing saltish therein.

For Trial whether the Effects of the *Alkali* Salt might be the same, or near so, on Sulphurs universally, whether volatile or fixed, I drop'd some Gutts of *Ol. Tart.* on common Spirit of Wine, and presently had an equable Cloud form'd towards the Bottom of the Glass, and of higher Colour than the liquid above. Just so when it was affused on *Ol. Oliv.* it formed a Cloud or *Lac* of an equable Surface to the Bottom; for the Oil above poured easily off, the conspicuously white *Lac* remained. The same succeeded with the Solution of *Sal Tart.* among Water poured on these Liquors.

As I here only consider the Analogy of Things, I have not to do with what is called the *Rationale* of them, or to account how the *Alkali*, which dissolves *Sulphur*, or renders it soluble, should in such manner appear to precipitate it, by Separation of Parts, an Effect rather belonging to Acids, as in making the *Lac Sulphuris*: Neither will the narrow Bounds I am confined to

allow me to enter on such Enquiry; and the rather that it will further appear that Chymists are yet much in the Dark concerning the *Phænomena* of these famed Salts, or what are generally reputed such.

I went on next to try what Appearances Spirits, both the alkaline and acid, could make on our Water.

By *Spirit of Hartsborn* there quickly rose a-top of the Glass an equable Cloud all over the Water, resembling much the Colour of old Brandy, which, in about an half Hour, vanishing, left the Water more milky, and as it were troubled. This seemed to answer well enough to the former Experiments.

Spirit of Nitre turned its native milky Colour into a fine light-blew, from the Top to below the middle of the Glass, and as it stood longer, the Colour advanced further downwards.

Spirit of Vitriol changed the whole Body of the Water into a faint Purple, or dilute Pink Colour.

As I could make nothing of the two last Trials, I try'd next Solution of *sublimate Corrosive*; and, by some Drops thereof on our Water, the same Manner of Cloud began to form immediately, but form'd out more gradually.

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The same Solution, on Solution of *Sulphur cum Alkali fixo*, made presently a *Coagulum*, but no equable Cloud.

By these, with the two former, it appears that the *Alkali* prevails in the Salt of our Water: But this can determine nothing concerning the Species of the Salt; as it will appear, that even the most reputed Acids of the Fossil Salts prove no less Alkaline upon Trials.

But what comes most to my present Purpose, is, That the Analogy hereby appears of the Effects of the strongest Alkalies and strongest Acids, both agreeing in forming an equable Cloud in our Water. And I conceive the *Coagulum* formed in the Solution of *Sulphur cum Alkali fixo*, to have arisen from the Cloud being confused by the Mercury being more disengaged of its acid *Menstruum*, by a stronger *Alkali* than is the Salt of our Well, and thereby precipitating in greater Quantity.

I found by the above Trials on *Scarborough* Water, the Analogy and Differences following betwixt it and our Water.

Ol. Tart. affus'd on it, form'd immediately a thick milky Cloud standing equable in a Minute or thereabout.

Solution of *Sublimate Corrosive* on the same Water form'd immediately a thin

white Cloud, rising to the middle of the Glafs.

• Solution of *Sublimate Corrosive* on our Water gives just such a Cloud as *Ol. Tart.* on *Scarborough* Water; and when it begins to diffuse itself, the Affusion of a little more of the Solution makes it become again more conspicuous.

Solution of *Sal Tart.* forms the Cloud in *Scarborough* and our Water alike; with this Difference, that in the *Scarborough* it formed more immediately, in our Water more gradually, but standing longer without diffusing.

I made a *Lac* of the *Scarborough* Water in the same Manner, and answering to the same sensible Qualities as that made of our Water.

The *Lac* may be made of both also, by a Piece of a Gall entire, or any such like Astringent, and *Sal Tart.* but not so pure.

Powder of Galls mixed with both, gradually turned both into a dusky green, with Foliages suspended through the Waters, in irregular Plains.

These, I think, are as near Resemblances as are readily to be found betwixt one Water of the Mineral Kind, and another; and any Variety that appears, may be owing to some Variety in the Salts of the one, not so
much

much, or at all, in their Nature, as in their Combination, or in some Difference of Proportion. To know what Account to make of these, and whether any Salt by it self, or in Combination with others, could come up to the above Appearances, I made the following Trials.

I made the Experiments as above on each of the Fossil Salts, and also on Sea-Salt dissolved in common Fountain Water, first separately, then on their various Combinations, as I could conjecture they might most probably prove, or be the Contents of our Water, but found none except the following come up to such Purpose.

Ol. Tart. on Solution of *Nitre* makes no Change of Consequence; but on Solutions of *Nitre* and of *Sea-Salt* mixed, formed a Cloud to the Bottom; but Solution of *Sublimate Corrosive* on the above Solutions mixed, made no Change, though remaining a considerable Time in the Glass.

Solution of *Sublimate Corrosive* on Solution of *Nitre*, made at first no Change; but some Minutes after, form'd a Cloud, as by *Ol. Tartar.* on Solution of *Sulphur* with the fixed *Alkali*, and on our Water.

Mixture of Solutions of *Alum*, *Nitre* and *Sea Salt*, made a troubled white.

Ol. Tartar. affused gave some Appearance

rance of a Cloud, not equable, but interspersed as in Precipitations, and swimming above the Bottom.

Solution of *Sublimate Corrosive* on the above Solutions, does nothing further than change the same into blewish.

Ol. Tart. on Solution of *Sea Salt*, for a considerable Time made no Change; but then falling down troubled, and making it as it were muddy to the Bottom, it gave some faint Appearance of a Cloud, but not so equable.

Ol. Tart. on *Sea Water* made immediately a white Precipitate, then quickly formed a thick Cloud, which some Time after precipitated an equable Cloud.

Spirit of Hartsborn on *Sea Water* formed quickly an equable Cloud or Suspension a-top of the Glass, about the Breadth of a small Straw, much resembling that made by the same Spirit affused in our Water; But I could observe nothing of that Whiteness nor Curdling that Dr. *Short* observed to be made by this *Spirit* and *Ol. Tart* on *Sea Water*. I at first suspected this Suspension a-top of the Glass by Affusion of the Spirit, to be only the Spirit a little ting'd, getting a-top, and tincturing both our Water and the Sea Water. To make sure whether it was so, I affus'd a little

little of the Spirit on good Spring-water, and waiting some time, I found no Change, and thereby perceived a further Improvement of the above Analogy, which I shall now state.

By the Trials above, it appears that no Salts come up to any Analogy with our Water and that of *Scarborough*, except *Nitre* and *Sea Salt*; but especially that of the Sea without Evaporation comes nearest. Yet none of them, either by themselves, or in their Combinations, come up to them in the Trials both with Acids and Alkalies; whereby it appears that the specifick Qualities of these Waters are not confined to either or both these Salts, or the Earths they lodge in. As on the other hand, these Salts being both sulphureous, thereby they the better correspond to a further sulphureous Principle in these Waters, answering more perfectly in the Analogy above-stated with Sulphur itself. The Inflammability of *Nitre* proves its sulphureous kind; and the Difference of the Salt of Sea-water before the Evaporation from prepared Salt, appears plainly above, from the different Effects of the fix'd *Alkali* on Sea Water, and on Solution of *Sea Salt*. This Difference is owing to the Sulphur of the Salt in the Water before Exhalation, as may appear
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from the volatile Alkali casting up the Suspension or Cloud above mentioned, which it doth not in the Solution of *Sea Salt* more than in common Spring Water; at least the one was conspicuous, the other scarce or not discernible.

This agrees with, and is confirmed by Dr. *Short's* Account of this Matter: For he kept Sea-water close cork'd and pitch'd, with a Bladder tied over the Neck of the Bottle a Month; then opening the Bottle, expos'd it a few Days, then shut it up close again: On opening the Bottle again after some time, he observ'd that it stank insufferably, not much short of the *Harrigate* Sulphur-well. The Doctor imputes this *Foetor* to a high *Alkali* in the Salt of the Sea; which I do not well understand, since no *Alkali*, as a pure *Alkali*, especially of the fix'd Sort, hath been observ'd to be foetid without being sulphureous, as I believe *Sulphur* hath hitherto been observ'd to be the Subject or *Substratum* of all *Foetor*; and the Smell agreeing with that of the *Harrigate-well*, should rather have determin'd its Quality to be of this kind: Therefore I rather would agree with the Doctor's Conclusion, that it contains *Nitre*, and ascribe accordingly the *Foetor* from its Corruption to the known Sulphur of that Salt; but

but it is not my Business at present to judge in such Things.

The last Thing I have here to observe on this Part of the Analogy is, That as *Ol. Tart.* on Solution of *Nitre* and *Sea Salt*, gives a Cloud, and Solution of *Sublimate Corrosive* on Solution of *Nitre* alone, gives also a Cloud, I tried to make a *Lac* of both, in the Manner I did by our Well; but I had nothing of either but a *Coagulum* swimming through each, without any *Lac* falling equably to the Bottom: So that hitherto I have found nothing but of the sulphureous kind, which gives a Cloud; neither can any thing but Sulphur itself, it seems, give a *Lac*. By a pure Accident I saw this further confirmed; One of the Mixtures I made of the Solutions of Salts as above, particularly of *Alum*, *Nitre*, and *Sea Salt* with *Ol. Tart.* affus'd, thrown at random into Soap-water, an equable *Lac* fell to the Bottom, leaving the Water clear above.

So far Analogy hath led me, and I have kept the Laws thereof the best I could, without straining beyond what Nature can easily bear. Other Ways have been thought on to get into the intimate Principles of Mineral Waters, but Success hath not well answered the Design; nothing hath yet been found

found to come over the Still, whereby we could have learned more for any real Use, than we could have attained to without that Labour. Chymical Mixtures to discover contraries by contraries, *Alkalies* by *Acids*, and *Acids* by *Alkalies*, have as little reached the Composition of natural Bodies, the Mineral especially. All the fossil Salts, which Authors have contended for, as the Contents of Mineral Waters are supposed *Acids*, and appear so more or less to the Taste; yet they have been all of them, the most *acid* not excepted, as *Vitriol* and *Alum*, found, by the Trials of the learned and ingenious *Mons. Tournefort* in his Preface to the *History of Plants*, to go less or more on the *Alkaline* Nature; as of the most *Alkaline* of Earths, *burnt Limestone* wants not its own *Acid*. So that upon the whole, these Names teach us less in Nature or Medicine than is commonly thought, whereas the Way of Analogy betwixt things known and things sought for, if right pursued, seems the most universal way, chalked out by Nature for us, in our Enquiries of Nature; and if it come not up to Demonstration, it still comes nearest to Truth of all the other Methods of Mens Contrivance. The learned have contented themselves with this Method in their
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Enquiries into *Steel Springs*. Galls with Infusion of Iron or its Vitriol, gives a higher or lower Purple: Therefore whatever with Galls strikes such a Colour, is concluded to be of Iron-Mineral; Why may not the same way of reasoning on all Mineral Springs be allowed?

To know the more adequately to what *Species* of Salt or Salts that of our Well and of *Scarborough* might be reduced by further Trials on them; I was at the Pains to compare and mark down the Agreement or Disagreement in every one of the fossil Salts, also in Sea Salt, as they were tried by the learned and ingenious Author above named; and from his Trials, compared with those above, and others to be yet named, on the Decoctions of these Waters, I found the Agreement of their Salts with Nitre and Sea Salt much nearer than with any other; though there is none of these Salts but what (by some Trial of the same Author) falls in more or less into the Quality of the other. The Particulars I would have marked here, but that they would have exceeded the just Bounds I ought to confine my self to: And if any have the Curiosity he may satisfy himself, by comparing the Trials with Mr. *Tournefort's* Book.

By

By the Experiments also of the same accurate Gentleman on the *Natrum* of the *Levant*, compared with these on Nitre and Sea Salt, and all three compared with his chief Enquiry concerning the natural Salt of the Earth, it appears that the *Natrum* and *Natural Salt* answer almost the same Trials, and that the *Nitre* and *Sea Salt* answer to both more than any other Salt; that is, Nitre and Sea Salt appear to make up the greatest Part of this universal Salt. And if to this we add his Discoveries concerning the *Natural Sulphur* of the Earth, we may hence probably have the more natural Account of such Mineral Springs formed by the Spring falling in its way through the Crannies of the Earth, into a *Congeries* or Beds of such Mineral Substances gathered together, as certainly it is from a greater *Congeries* of Mineral Particles under or above the Surface of the Earth, serving as Embryo's of concrete Minerals, that such Minerals are formed. I am glad that Dr. *Short* seems to account for the comparative Strength or Weakness of one and the same Mineral Water at different times, as well as of two Springs of the same kind, from some such Thought as this. It would also hence seem that we need not be over-anxious in finding out or searching after *this*
or

or *that* concrete Mineral in the Neighbourhood of any Mineral Springs, for determining its Nature or Contents; though still the Presumption may be strong in such Case, that the one qualifies or assists the other. But after all, this Presumption does not come up to Certainty; for the same learned Author hath observed, that notwithstanding the *Alum-stone* in the Clefts of the Rock through which the *Scarborough* Water flows, yet it hath nothing of *Alum* in it.

I thought it best to finish this Analogical Enquiry into our Water, and to give it entire, and in its native Condition, before I should enter on Examination of the Contents got by Evaporation of the Water.

I caused to dig as deep as could be well reached, with a small Shovel, along the Bottom of the Sand-lays, through which the small Springs of the Water run, separating some Pounds of the Sand from the adjacent Clay: This I boiled leisurely in about four *English* Quarts of the Water to a half; then pouring off the Water, I strain'd it through gray Paper. This I put to a slow Evaporation on the Fire, observing if any *Pellicule* appeared, but I saw none. After drawing off the remaining Water with Bits of gray Paper, and evaporating the Moisture at the Sun, the *Residuum* came to about

bout five Grains of a black Substance, scintillant in thin *Foliages*, and of a fattish Taste. I put this in two Drachms of Spirit of Wine rectified, and had gradually a sulphureous greenish yellow Tincture. I dropt a little of this into a Glass of Water, which shewed itself quickly a-top, of an equal Surface; and after some Hours advancing downwards, its Colour became more dilute to the Bottom. Then I dropt on it some Gutts of *Ol. Tartar.* which formed a Cloud to the Bottom, equable and waving by the Motion of the Glass, as above-narrated.

Having poured off this Tincture, I put on the *Residuum* about the same Quantity of Spirit of Hartshorn, which drew a black Tincture resembling a *Bitumen* by its Thickness of Consistence. I poured Water on it, and it fell to the Bottom without mixing with the Water: After standing a while, it rose up again gradually, but did not incorporate with the Water. Some Gutts of the Solution of *sublimate Corrosive* precipitated it, and let fall a black Powder. This, after drying, I cast into a red-hot Iron-spoon, and it sparkled all over; but cast after on a Live-coal, it sensibly flam'd blue. I threw the remaining *Residuum* three several times after into the red-hot Iron-spoon, it still sparkled as before, remained
black,

black, and its scintillant Particles shewed themselves as at first. To try further what the Heat of a Furnace could do, I put it into a Crucible placed about five Minutes in the most intense Heat of a Goldsmith's Furnace, and got returned me near one half; after it had stain'd the Bottom of the small Crucible with an indelible black Colour.

I tried next whether the *Lac* I had made as above would prove inflammable, by putting it on a Fire in an Iron-spoon, but I had no Fusion nor Flame by the Heat increasing; on the contrary, when the Spoon became red, my *Lac* turned into a black Cinder; but having thrown some of the *Lac* into the Spoon first made red-hot, it presently took Flame, and continued so till it burnt into black Ashes.

I would next try what a Heat increasing leisurely would do with some *Lac sulphuris* I had lately made with the *Calx viva*; it did not flame in the red-hot Spoon, but burnt to Ashes. I tried the same with the officinal *Lac sulphuris*, but neither did it give any Flame till the Fire was too hastily increased: But then the Spoon being taken from the Fire, the Flame ceased; and the Spoon being put on the Fire again, the *Lac* burnt also into Ashes without Flame. I tried also some *Sulphur of Aix* in the same

F

Manner;

Manner, and the Success was the same, it being reduced into a red Cinder, which gave no manner of Flame when thrown into the red-hot Spoon.

These Things it may be are Paradoxes concerning *Sulphur*, the whole whereof is believed to be inflammable, in whatever manner it is treated on the Fire.

Some Time after I tried in the red-hot Spoon a *Lac* I had made of *Scarborough Water*; but it flam'd not openly, though put on the Fire; only in about a Minute it shined above the Brightness of a Live-coal, and resembled a *Phosphorus*. Having at the same time by me a *Lac* I had formerly made of our Water, I treated it in the same Manner, and the Appearance was just like to the other, both continuing in that bright State a pretty good Time before they were reduced to a black Cinder; whereas when the *Lac* of our Well broke out into open Flame, it quickly changed into a Cinder. I tried in the same manner a little of the *Residuum* of *Scarborough Water* after Evaporation, much resembling in Colour the *Lac* of both, and the Success was just the same.

Though I think this Appearance on the Fire demonstrated a Sulphur in the Contents of both Waters, I had various Con-
jectures

jectures why the *Lac* of our Well had not answered to open Flame as formerly; I afterwards thought on yet a surer Way to try the Inflammability of the Contents of both. I caused a Crucible to be made red-hot in a Goldsmith's Furnace, then having removed all flaming Coals from the Neighbourhood of the Crucible, that any Flame without might not confound the Appearance within the Crucible, I cast some of the *Residuum* of our Well into it; and ordering to push the Fire by blowing the Bellows, I saw the Flame within the Crucible gleaming, then filling the Crucible, and continuing so a considerable Time, the Bellows still going. Then having emptied the Crucible of the *Residuum*, I tried in the same manner the *Residuum* of *Scarborough Water*, and the Success was the same.

In these Trials it was not possible to approach so near as to feel whether the Flame smelled of Sulphur or not, only it was more white, and going more on the Colour of the Flame of *Nitre* in Detonation. For understanding what Reason there might be for such Appearance, I reflected on what I had formerly observed, on a Parcel of the *Residuum* of *Scarborough Water*, that in two or three Days, by Attraction of a moist Air it had augmented considerably, both in

Bulk and Weight: Also considering a vulgar Expedient to make smoaking Coals burn clear, by throwing Salt upon them, I thought that the Salt's impregnating the Waters as above, might in great measure procure the Difference. To determine this, I cast equal Parts of *Sulphur* and *Sea Salt* in Powder into a red-hot Crucible, whence immediately arose a white Flame, going on the blue towards the End; but at the nearest Distance I could approach my Nose, I could perceive little or nothing of the sulphureous Steam; neither were others who stood by sensible of it. The Flame ending, what remained was a grey acrid Concrete. Nitre and Sulphur, mix'd also in equal Quantities, and thrown into the Crucible, gave much the same Flame with a *Sibilus*, but no sulphureous Steam perceptible by me, nor others standing by. After some Time flaming, the Mass went into Fusion as a Rosin at the Bottom of the Crucible.

Hereby appears that the Salts attract the Smoak of the Sulphur, imbibing it by the same Mechanism as one of them attracts that of Coal, and both of them the Moisture of the Air; and so I think the Difference of Flames, as above stated, may be understood.

For finding whether there might be any thing *Regulin* or *Metallick* in either of these

these Waters, I mixed both *Residuum*s with one half *Tartar* and as much *Nitre*. I tried first that of *Scarborough Water*, the Quantity being about two Drachms, which was kept ten Minutes on the strongest Furnace-fire in a Crucible, with a Cover of its own Kind. After cooling it was easily shak'd out, retaining the Form of the Bottom of the Crucible, and being white as before exposed to the Fire, only interspersed with some blackish Particles, and on the upper Surface appearing porous, and the whole resembling a spongy Concrete of salt and chalky Earth, the Taste acrid, the Weight exceeding but very little the Weight of the *Tartar* mixed with it.

Before trying the *Residuum* of our Water in the same Manner, it came into my Thought what Appearance it might make when thrown into a red-hot Crucible before being put into the Fire. When this was done, it began to boil immediately with sparkling, and then cast up a thick Cloud of Smoak with a high bituminous Smell. I regreted I had not thought on doing so by the *Scarborough Residuum*, and the rather that I had no more of it for Trial, yet what is said may in great measure supply this Omission. The *Residuum* of our Water appearing in Fusion on the Fire, and after

it cooled, adhering so close to the Crucible, that it could not be got out but in Parcels by an Iron-bodkin, it looked like a hardened dark Rosin, and had an acrid Taste : Which Appearances compared with that above of the Fusion of Sulphur and Nitre into the same manner of Substance, is, I think a good Addition to the Proof of our Well's *Sulphur* going more on the nitrous Kind, as the Appearance of the *Scarborough Residuum* compared with what remained after flaming of Sulphur and Sea Salt, may prove that its Sulphur goes more on this Salt, and that both are lodged in a calcarious Earth as a *Substratum*, wherewith, as by after Trials may appear, they are both so combin'd, especially the sulphureous Part, that the Violence of Fire cannot disengage them, so that the Sulphur does not always discover itself.

The Decoctions of both Waters, when farther carried on, may give further Light into the above Comparison. I boiled an *English* Quart of each to about two Ounces, and observing the Progress, I found our Water become still of a deeper Colour, till about six Eighths being boiled in, it became like to a strong Decoction of *Guajac* Wood, in the Smell, Taste and Colour; that of *Scarborough*, when boiled that far, resem-

resembling rather the Colour of Whey, and having the Taste more briny, in respect of the resinous and mellowy Taste of the other.

I attempted next to find if any of the Substances usually employed in trying Mineral Waters, when mixed with the Decoctions of these Waters, and by comparing their Effects with those observed upon their Mixture with the fresh Waters as above, would, by the Difference, discover any thing further concerning the Nature of the Salts in the Waters, particularly, whether and how far they might be accounted volatile or fix'd, whereof I could discover nothing that could be relied on in our Water kept, some of it a Month, some two Months, in Cask or in Bottles, shut or open, simply corked, or with the Corks laid over with Pitch; as neither could I perceive any Difference of Smell but what was common to any Spring-water when kept a considerable Time.

To extend this comparative Trial a little farther, I took in two other Substances than were formerly employed, to wit, Syrup of Violets and Tincture of Turnsole, for which last, after *Mons. Tournefort's* Way, I made use of blue Paper.

1. *Syr. Viol.* turned both our Water and that of *Scarborough* into green.

2. Blue Paper dipt in our Water changeth not, only the blue appears more intense in our Water. No Change at all when dipt in *Scarborough* Water.

3. A Decoction of our Water changeth not by *Syr. Viol.* neither does the blue Paper change its Colour thereby. But,

4. *Scarborough* Water evaporated to one half, becomes by *Syr. Viol.* conspicuously green. Blue Paper dipt in the Decoction changeth not Colour.

5. Solution of *Sublimate Corrosive* on Decoction of our Water, at first makes no Change, but some time after troubles it into a whiter Colour, then precipitates a dusky *Residuum*.

6. Solution of *Sal. Tart.* on the same Decoction, gives presently a Precipitate equable as a Cloud.

7. Solution of *Sublimate Corrosive* changeth the Decoction of *Scarborough* Water gradually into a troubled dusky grey.

8. Solution of *Sal. Tart.* on the same Decoction, makes no notable Change.

9. Infusion of Galls changeth not the Decoction of our Water, but presently makes a *Coagulum* in Decoction of *Scarborough* Water falling downwards from the Top.

By

By the *first* of these Trials it appears that the Salt of both Waters in their native Condition goes most on the *Alkaline*, as it appears, by *Mons. Tournefort's* Trials, the natural Salt of the Earth also does, whatever may be generally said of its acid Nature. It seems by the *third* and *fourth* compared, that the Salt in our Water is more of the volatile Sort, agreeing hereby more with *Nitre*. The *fifth* also may seem to confirm the same; but the *seventh* makes this more ambiguous, and the *sixth* renders it yet more doubtful; and the *sixth*, compared with the *eighth*, might rather seem to give the Volatility to the Salt of *Scarborough* Water; but the *ninth* to restore the same still to our Water. In such counter Appearances I tried if any thing more certain could be made out, by affusing a little common Water on the Remains of the *Residua* of both Waters left in the Crucibles, after trying their Inflammability, as above. On these Infusions I made over again the same Trials; but Appearances were so little consistent to these above, or to one another compared, that I found little else but the Folly of thinking by such chemical Attempts to reach Nature further than Conjecture reacheth; and that, as I said before, all we can pretend to, by such Trials, is to find out by

Ana.

Analogy, the Congruity or Incongruity of one thing we know, with another we seek after, without pretending hereby to come at the intimate Principles of things, which we have hitherto in vain been hunting after by such Means. All that we may account certain is, That Nature affords nothing pure *Alkali* or pure *Acid*: Or, in other Terms, whatever it be of any Product of Nature, which is proved of the one or the other Nature by one Trial, may be proved also of the contrary Nature by some other different Trial. This *Mons. Tournefort* hath proved by Multiplicity of Experiments on the natural Salt of the Earth, on the *Natrum* of the *Levant*, on Sea-salts and all fossil Salts. In fine, the Violence of the Fire cannot quite break this Make of natural Bodies, so as to deprive it quite of its native Texture, as he hath also proved by his Trials on *Lime-water*, that the *Acid* hath still a Being in burnt *Lime-stone*. And I had been tempted to suspect, that all my Trials of Analogy failed of proving the sulphureous Quality of our Water, by several of the Attempts to burn the *Residua* failing, when they were exposed to the greatest Violence of Fire in a Crucible, had I not seen the Flame of the same *Residua* in the Furnace before. But what
more

more Mystery is in this, than in Steel Waters failing in the Trials by being exposed to the least Evaporation, either when open to the Sun, or even in the common Air, without any sensible Influence of the Sun's Heat, and yet nothing properly volatile is to be found in Iron, or its Vitriol? Such Things put the Minds of Men to a sort of *Nonplus*. Yet still we must take them as we find them, and be determined by Nature, and not by our Reasonings.

I resolved next to have a greater Quantity of our Water, for Evaporation to a *Residuum*, and to prepare it better for Dissolution of its compounding Parts by Putrefaction. For this Purpose, I put twelve *English* Quarts into a small Cask, which I shut up close, with the Mouth pitch'd round, and placed it in a Cellar during five Weeks; and put about six Quarts more in Glass Bottles, some simply cork'd, others also pitch'd, others open, some exposed to the Morning Sun, others in a Cellar. I told before, that by my Smell, Taste or Trials, I could find very little Alteration in our Water, other than the Taste and Smell the simple Element has in such Case. These eighteen Quarts I put on the Fire to boil, and evaporate in two Brass Pans, one smaller, the other larger; the smaller was open for
most

most part during the Boiling, the larger was covered from Beginning to End. The Quantities in each I did not mark. I had of Sediment of the lesser, *Gr.* xxxiv. of a grey dusky Powder, as in Evaporations formerly. The Residence of the larger I observed coming to the Consistence of *Bitumen*, and of a black Colour, the Decoction accordingly smelling and tasting high of the same Kind. I poured off a little remaining Water of the Decoction, and dropping on it some Gutts of *Ol. Tart.* I found still the Cloud form'd, and standing all the Day without any curdling Precipitate. I found the *Bitumen*, after the Water was evaporated before a Fire in a Tea-plate, weighed *Gr.* 170; and exposing it again to the Fire till it became a Rosin, I had *Drach.* ii. *Gr.* xi. Of this I threw several Parcels into a red hot Crucible, placed in an ordinary Fire of no intense Heat, and every Parcel quickly flamed about two Minutes, then almost vanished. I next tried the Powder I had as *Residuum* of the smaller Decoction; but it did not flame, but jetted out Sparkles of Flame, huzzing as wet Gun-powder does, when touched with Fire. I can attribute this Variety to nothing else but the larger Pan's being covered during the Decoction, whence I had the *Bitumen*; and upon Sight
of

of it, compared with its Taste and Smell, concluded that I should have my *Residuum* more inflammable, or easier to take Flame than formerly. Of such Consequence it may be, more than we ordinarily think on, to have our Decoctions, whatever they be, more or less circulated.

Upon the whole it may appear, that Analogy right stated, and justly regarded, is the surest Way by which our Reason is capable to lead us into the Nature of Things; and that Experiment justly stated and managed will always answer to such Analogy. And hereby is confirmed the Likeness of our Water to that of *Scarborough*, as to their specific Contents, though in Proportions different from each other; the Salts abounding more in that of *Scarborough*, the Sulphur appearing to abound more in ours, the different Bulk or Weight of the whole considered, which is much greater in *Scarborough* Water than in ours. And yet it will next appear, that equal Quantities drunk, the physical Operation of ours hath proved not inferior. Analogy hath taught me the Presence of these Salts; Dr. *Short* and Dr. *Shaw* have found them by direct Trial. Thus does the Fact confirm the Analogy, as I stated it betwixt the Experiments on different Substances, and these
on

on our Well, and of Consequence betwixt our Well and that of *Scarborough*. The Evidence appears equally concerning the *Nitre* and *Sea Salt* in both. Concerning the respective Quantities whereof in each Water, I had Occasion to make an Observation pretty remarkable, but whereon at first I was little thinking.

Having remark'd, That a Parcel of the *Scarborough Residuum*, two or three Days after evaporating its Moisture, appeared considerably more bulky, I weighed and found it *Drach. ii.* very near, then put it in a Tea-plate, before a warm Fire two Hours, and found the Weight diminish near one Third, which answered to my Suspicion, that its comparative Bulk was from the moist Air it had attracted, the Weather having been somewhat foggy. I had observed no such Appearance in any *Residuum* I had got of our Well: But to be more sure, I tried in the very same Manner, while the Weather was moist, *Gr. xviii.* I had remaining of the *Residuum* of last Decoction. When the Plate was taken hot from the Fire, I found the Weight diminished not above *Gr. i. sem.* This with the comparative Colours I always observed of the *Residua* of each, that of *Scarborough* Water going constantly on the grey white, and
that

that of our Well on the dusky brown, less or more intense, proves still the Prevalence of the Salts in *Scarborough* Water, if not of the calcarious Earth, and of the *Sulphur* in ours. To which, *finally*, may be added, that having brought my last Decoction of our Water to about a Gill, I dropped thereon some *Ol. Tart.* and it form'd a thick Cloud of an equable Surface and Consistence all over, and standing firm several Days, without separating till broken on Design, which had not occurred to me before in any former Trials; and it appears above, that Decoction of *Scarborough* to one half, gave no such Appearance.

P. S. As I could not, by Evaporation, bring our Water at any Time to cast out any Crystals, I designed, at last Decoction, to have tried the Salts adhering to the Sides of the Pan; but not finding how to determine any thing thereby, and fearing to transgress my Bounds, I caused them to be washed down into the Decoction.



IX. *Medical Qualities of Montrose Well, with some Instances thereof; by the same.*

THE Water of this Well is of an obscure Mineral Taste, which cannot well be described. It is lighter on the Stomach, and easier to digest than the finest ordinary Spring Water, or any other of our Mineral Springs; so that delicate Constitutions bear it easily, and are improved by it in their Appetite and Digestion. A Man about seventy Years of Age, and of a decrepit Habit, bore easily, even when he began first to drink it, two *English* Quarts in the Morning, and near as much after Noon, with Alleviation of a Cough he laboured under, and told me, though he was of a low Station of Life, he could never formerly bear a Draught of any manner of Water.

It clears the Spirits of Heaviness, and gives Life to the inward Powers, even of these of the more sober and low Diet. The simple Element, whether cold, or hot infused on Tea, by diluting, and in either
Way

Way, by its *Stimulus*, washing off the Indigestion, which clogs the natural Faculties, in those of high or full Diet, serves so far well to this Purpose. But those of slender Constitutions, and who live on low Diet, have found this Effect by a few Cups of this Water. Some of the more sober and delicate Females have also experienced this. And a Gentleman using the vegetable Diet, and of the animal, nothing above Milk or Eggs, and the simple Element for Drink, of a thin Habit of Body, and with lively Spirits, found himself generally yet more chearful, and his Appetite and Digestion improved, by drinking only about an *English* Pint.

It is universally diuretick, People accounting generally that they pass more that Way than they drink.

Being drank from two to three Pints *English*, it generally purgeth by Stool three or four Times, the half of that Quantity succeeding in some. By this Quantity a Gentleman, from beginning to drink of it, was set a purging three or four Days together, during which he was obliged to refrain its Use, and afterwards to diminish the Quantity, till he was more accustomed to it. The more plentifully one feeds it generally operates more, as hath been obser-

ved concerning other purgative *Spaws*. In some the same Degree of Operation hath continued during the Use of the Water: But generally as People are more accustomed to it, they are obliged to intermit at Times its Use, or to augment the Quantity.

Soon after its medical Virtues were first observed, it performed a Cure, scarce inferior, I believe, to most, or any recorded in Observations of Medicine. A Girl during nine Years, almost from a Child, afflicted with Strangury, Stoppage of Urine, and, for most Part, of the Evacuations of her Belly also; her Urine being constantly as a thick Gleet, and resembling the Mucilage of Oat-meal; she having, during most of the above Time, scarce any Intermission of Symptoms, whereby her Flesh became wasted, and her Strength so much impair'd, that she went on Crutches, or otherwise supported. At length the Paroxysms taking her constantly so soon as asleep, she became as one insensible, talking, and answering Things spoken to her out of Purpose. She being then supported to the Well, began immediately, being under no Direction, to drink freely, and it passed by Stool and Urine as freely, with immediate Ease. This encouraged her to too much Freedom, till overcharging

charging Nature, she was threatned with a Suffocation, and hereby was taught to use it more moderately. I gave her some Directions for drinking it afterwards; and, the Evacuations still succeeding, she not only was cured of all Disease in a few Weeks, but also became of a clean and natural full Habit of Body; when she declared, that for nine Years bygone she had not enjoyed so much Freedom from Trouble, taking all in one, as she had since she began to drink the Water.

In general, as a good many in various Symptoms of Gravel and Nephritick Pains, have come to it for Relief, so I have found none who have not been more or less, and most of them remarkably relieved by it.

A Gentleman during a good many Years afflicted with Paroxysms of the Stone, rarely under twice a Year, and sometimes they seized him more frequently, each Paroxysm only going off after passing Stones of various Bigness, by drinking in the Morning the above Quantity, or a little more of this Water, it going off plentifully by Urine, and by moving the Belly a little, became fresher in all his natural and animal Faculties, and has continued almost a Year free of all Nephritick Paroxysms, except some small Threatnings. He then left this

Place, and I know not how he has been since. One Circumstance in his Case was most remarkable, that during the Use of the Water he passed Urine always without any *Stimulus* or Inclination to pass any more, which had constantly affected him before, since the first Attack of the Disease.

Another Gentleman, during several Years under grievous Symptoms of Strangury, and sometimes passing Gravel, several Means of Relief, and particularly the *Aberbrothock* Water being used to no Purpose; at last there was strong Suspicion of an Ulcer in the Neck of the Bladder where he ailed most, from a purulent Matter passed with his Urine. After all Hopes of Life were almost gone, he began insensibly to become easier of the Symptoms; but the Disease still remained, and particularly his Urine passed with Difficulty, and he had violent Pain from the Strangury always after passing it. From beginning to drink a Pint or little more of the *Montrose* Water in a Morning, and drinking it warm infused on Tea after Noon, his Belly being opened a little after his Morning Draught, he began to pass his Urine every Day with more Freedom: The Pain diminished also daily; which good Effects he had not found before
from

from any Water simple or medical, neither from any other Liquor he drank.

As it generally relieves in all scorbutick Symptoms, and Foulness of the Blood, so hath it perfectly cured several inveterate Scurvies in the Younger and Older, above any Effects of medical Waters I have hitherto observed.

A Gentleman, otherwise of a strong Constitution of Bowels, and of a vigorous Body, but labouring a good many Years under the foulest Eruptions on his Skin, almost coming to a Degree of Leprosy, by drinking from three to four *English* Quarts a Day, which gave him three or four Stools, and dipping his Shirt among the Water for a Bath over Night, was, from the worst Degree of Eruption he had been liable to, brought, almost incredibly, to a perfect Cure, in less than three Weeks. The Eruptions that were thick, inflammatory, and sending out a *sanies*, as I observed them in the Beginning, going all away, and his Skin becoming all over soft and smooth, as I also saw; and he has continued sound and in perfect Health now above a Year, sometimes drinking the Water at about six Miles Distance.

A Woman of about sixty Years of Age, of a valetudinary State of Health, and par-

ticularly much afflicted, during several Years, with scorbutick Runnings over several Parts of her Body, her Head also being greatly affected in the same Way; Diet-drinks of several sorts given and repeated proving of no Use, by about a Month's Use of about three *English* Pints of this Water a Day, whereby she purged three or four Times daily, was entirely cured, and remains so now more than a Year.

A Girl seven or eight Years of Age, labouring, almost from her Birth, under a dry itching Scurf over her Skin, and several Measures being taken for her Cure in vain, by drinking three Weeks daily, about two thirds of a Pint of Water a-Day, whereby she had the ordinary Stools, and bathing therein twice a Week, was made entirely clean. And the Disease having threatned sometimes to return by unguarded Treatment, she hath been always cured by the same Means, and is now perfectly sound.

By other Instances of Cures made, or Relief given by the Use of our Water, it would seem to be of pretty good Service in most chronical Diseases, and to reach from the first Organs of Digestion, to all that affect the Blood. In Winds and Flatulency stifled in the Bowels, it hath proved of good use, breaking the Wind with such Force that
People

People, the Females especially, have been afraid to drink it in publick; and some who have been long afflicted this way, have been perfectly cured by it. Others have found Benefit by this Water, who could not bear drinking the simple Element cold. So hath it also made complete Cures by Stool and Urine in spasmodick Colicks, called by the Vulgar windy Gravel. To this Class we may even likewise bring the Case of a Woman labouring under racking Pains of her Breast and Head, who, having passed turbid Urine in large Quantity, by drinking it, was cured without any purging.

It has also been beneficial in disordered Secretions from the Blood, and where the Liquors have been in a stagnating Way. Among the rest, the Case of a young Man was remarkable, who after a *Tertian* Ague of three Months Continuance, having swelled all over the Belly, Arms and Head, was cured, by drinking without Allowance what he could of the Water, from Sun-rising in the Beginning of *August*, to about nine a-Clock every Day of two Weeks. But the Case following is more singular.

A Woman falling into Blood-spitting, (supposed to have been occasioned by a Strain some Time before) which continued about a Year and a half, recurring less or

more every three, or at most four Days, and frequently sooner, notwithstanding her menstruating regularly, from the Time she began to drink this Water, which she continued for two Weeks or more, she spit none, neither did any bad Symptom appear, although the Water operated every Day, both by Vomiting and Stool. She began by drinking two Quarts. On hearing which, to prevent such Operation, I ordered her to take not above the Half; notwithstanding this, it continued to have the same Effect; and I am just now told, that she continueth well.

In Rheums and Strains also I have found it of good Use, by way of cold Pump, where the Persons could not bear such use of ordinary cold Water.

A Gentlewoman of a thin Habit, and advanced Age, being afflicted with a Rheum of a pretty long Continuance in her Arm, had the Pain allayed, and the Rheum as good as quite cured, by the Water used in that Way: But the Rheum some Time after attacking the other Arm, she was afraid to admit of the Cure.

A Gentlewoman having strained her Foot, whereby, notwithstanding Variety of Cures, she was confined during most of a Year, could not move her Toes, nor put her
Sole

Sole flat and even to the Ground, the Flesh of her Leg being also remarkably wasted, her Skin became discoloured, rough, and as it were dried; not having been able to bear the Application of ordinary cold Water to the recent Strain, by bathing and pumping this Water on her Foot and Leg, about two Weeks she began to move her Toes, then all her Foot freely, and rested it level to the Ground; her Leg also recovering its native Colour and Softness, and becoming plumper; so that she began to walk about a little, supported by a Crutch, and sometimes only by a Staff, when by an unhappy Accident falling on the same Leg again, and her Foot folding as it were under her, all her Ills returned to almost a worse Condition than in the Beginning: And she, after not finding the immediate Benefit of the Water, was impatient to lay it aside, that she might try other Cures, which hitherto have had no Success.

A poor Man at once paralytick of his Limbs, and wrong in his Judgment for several Years, as I am well informed, coming to our Well on Crutches, without which he could not stir; in a few Weeks, by drinking what he could get of the Water, and bathing his Limbs in it when he found none to hinder him, was so well cured,

not

notwithstanding his being seen drunk at Times, that I saw him walking about sound, carrying his Crutches.

I could have given other Instances of Cures done by this Water, had not my Avocation in the Country, and Business when in Town, detained me from so closely attending the Well in this as in the former Season. But perhaps these are enough for the Bounds of this Paper.

The Disadvantages of our Well are its being a little too much exposed, being close on an open Road, without convenient Covering for walking about; This could not be well helped without some Apartment erected for the better sort, Females especially. Then the Spring is but small, giving only two *English* Quarts in a Minute, too little for affording sufficient Water for the Demands of bathing the Body, but more especially for the Drinking of any Confluence of People. To remove both Defects, I will endeavour, next Spring, to have a Stone-Bason with a Cover, made as a Reservoir for the Water in the Ground below the Well.



X. *An Essay on the Method of preparing and preserving the Parts of animal Bodies for Anatomical Uses; by ALEXANDER MONRO Professor of Anatomy in the University of Edinburgh, and F. R. S.*

THE most artful Management of the Knife alone cannot discover the Texture of Animals sufficiently; Anatomists are therefore obliged to employ several other Arts, which often require a considerable Time in their Execution, and frequently fail through some Unfitness in the Subject, or by a very small Omission or Accident: And when they succeed in any Attempt of this Kind, they endeavour to preserve the Parts thus prepared, that they may always be in Readiness to supply what cannot be demonstrated on the recent Subject. While each Anatomist is obliged to his own Industry only for the Discovery of these Arts of *preparing* and *preserving*, it is probable that frequent Disappointments, and the Despondency these will create, may discourage many from pursuing the Study of *Anatomy*, who might become
the

the greatest Improvers in it, if these Difficulties did not ly in their Way. With a View to remove them in some measure, I shall lay before you in this Paper such Arts of preparing and preserving the Parts of animal Bodies as I have found successful, which may serve as a Foundation on which others more industrious or ingenious may build.

The principal Preparation that BONES require is to make them white ; for which Directions are given at considerable length by *Paulli* (a) and *Lyserus* (b), who also teaches the Method of putting the Bones of Adults together. What I have found most successful for whitening the Bones of young Creatures, is macerating them long in cold Water, which ought to be changed frequently ; the Bones being laid out each Time to dry a little in the Sun. If they ly too long in the Water, even those of Adults will dissolve in their more spongy Parts, and the younger ones lose all their *Epiphyses*. If they are allowed to dry before the Blood in *their* Vessels is melted down by the Maceration, it scarce can afterwards be separated from them, or they will never become white. The Marrow of
young

(a) Act. Hafn. Vol. 2. § 18.

(b) Cult. anat. lib. 5.

young Bones being much less oily than in Adults, they generally can be made much whiter, and do not so readily turn yellow by keeping. The Bones of *Fætuses* require to be taken frequently out of the Water; and the *Periosteum* must not be separated where the *Epiphyses* are joined, otherwise it is scarce possible to prevent the Loss of these additional Pieces.

The Method of burning and exposing the Bones of Adults long to the Weather, for unravelling their Texture, is so generally known, I need scarce mention it.

CARTILAGES are made pellucid in the same way that Bones are whitened, and they must afterwards be brought to their natural Shape and Situation, in which they are to be kept by Strings, Weights, Pins, and such other Contrivances, if they are to be preserved dry.

The MUSCLES that have no large Cavity are to be laid and secured in the Posture they are designed to be preserved in, and they are pressed with the Fingers into a natural Shape while they are drying.

You have already published all I know of the Method of injecting the VESSELS. [See *Art. IX. of Vol. I.*] That they may appear better, it is necessary to macerate in cold Water all injected Parts that are coloured

loured with Blood, till the Blood is extracted; after which the Water is to be pressed well out, and, even when the Preparation is to be preserved wet, it is of Service to let it dry a little in the Air, before it is put into the embalming Liquor. But before the very minute Extremities of injected Vessels can be demonstrated, there is a farther Art requisite, which is the same that has been employed by several of late for unravelling the Texture of Leaves and Fruits, of which *Severinus* (a), near a Century ago, says, *Verum me ineptum, quid præterieram Opontii Folii resolutionem artificiosam: parabitur hæc porro simplici tabefactu per affusam uberem aquam tamdiu complexuram, dum fibris lignea duritie restibilibus, omnis exsolvatur carnea portio.* And *Ruyfch* (b) at last acknowledged his Method of preparing the succous Vessels of Fruits, and of the Brain, &c. to be the same. Put therefore the injected Brain, Lungs, Liver, Spleen, or any other Part of a tender Texture into Water, allow it to remain there till its involving Membrane is raised by the Water insinuated into the cellular Membrane, which connects it to the Parts below; then
 separate

(a) Th. Bartholin. Epist. Med. Cent. 1. Epist. 65.

(b) Advers. Anat. Dec. 3. § 2.

separate the Membrane, and afterwards keep the Part among the Water till the Fibres connecting the small Vessels are dissolved: This is known by shaking frequently the Part among the Water, which washes off the corrupted Particles, and at last the succous Vessels are seen distinct and floating in the Water; then the Preparation is taken out, and, by gently pressing, the Water is squeezed from it, the Remainder of it being washed away with some of the preserving Liquor into which it is immediately put, and, by a little Twirle of the Thread or Hair by which it is suspended, the Preparation is expanded, and the small Vessels are separated.

I never could divide NERVES into their very small Filaments after they had got their firm Coat from the *Dura Mater*, but before they are involved in that Membrane they are easily divided. Those that constitute the *Cauda Equina* are fittest for this Purpose; for they are long, and their Fibres adhere by very weak fine Membranes. One of these Chords being cut through, where it comes off from the *Medulla Spinalis*, and where it is about to enter the *Dura Mater*, one End is secured with a Hair, by which it is suspended in a Bason of Water, and after macerating some
Time

Time there; it is raised to the Side of the Bason, upon which it is laid, while one Hand holding the Hair, with the other a very small Needle fix'd in a Handle, is slightly strip'd along the Nerve. Let this Operation be continued, till upon twirling the Nerve among the Water, it is expanded into a fine Web of very small Fibres, when it is put into the embalming Liquor. If the Blood Vessels were previously injected, the Hair must be tied on the End of the Nerve nearest to the *Dura Mater*, that the Trunk of the Nerve and Artery may appear together: When a Piece of the *Cauda Equina* is thus prepared, it shews very prettily; for each Filament almost of the Nerve appears with injected Vessels upon it.

When a fine single MEMBRANE, such as the *Pleura* or *Peritoneum*, are to be preserved for demonstrating their Arteries after an Injection, as much of the cellular Membrane, by which they are connected to the neighbouring Parts, is to be saved in dissecting them off as can be done, without spoiling the Transparency of the Membrane; for when the cellular Substance is wholly separated, very few continued Ramifications of Vessels can be seen, a great Number of exceeding short Extremities only appearing, which require a Micro-

Microscope to view them distinctly. When there is little Fat lodged in the Cells, the Membranes of the cellular Substance may be left without a Possibility of observing them: When they are filled with Fat, it must be pressed out as much as possible, after being well macerated. Even when Membranes are to be preserved in a Liquor, they are more easily kept extended in it, and their Vessels are better seen, if they are previously dried. In doing this, they must be extended with Pins or Threads on a finely polished clean Board, or it is rather better to keep them on the Stretch while they are raised up from it, that they may bear no Print of the Board. After Membranes are dried, their doubled Edges or other Inequalities are to be cut off with a Pair of Scissars.

Ruyfch (a) describes the Manner of separating the *Cuticula* and *Corpus reticulare* from the Skin, by stretching these common Teguments, well freed from the Fat, on a Board, with the *Cuticula* outmost; and then dipping all into boiling Water, which loosens the *Cuticula* and *Corpus reticulare* so from the Skin, that they are easily separated with a blunt Knife, or the

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(a) Adv. Anat. Dec. 3. § 2.

thin Ivory Handle of a Scalpel; then with the same Instrument he separates the *Corpus reticulare* from the *Cuticula*, leaving them connected to each other, and to the Skin in some part. After this they may be either dried or put into the embalming Liquor. When either the *Corpus reticulare* is not made firm enough by the hot Water, or happens to be very thin, it is difficult to separate any considerable Piece of it entire from the *Cuticula*.

A *Chirotheca* or *Podotheca*, a Glove or a Shoe of the Scarf-skin, with the Nails adhering to it, is brought off with very little Trouble after the *Cuticula* loosens from the Parts below by the Putrefaction, which keeping a Subject long brings on. This Method answers the Design better than forcing off the Scarf-skin with boiling Water, which makes the *Cuticula* tender.

The *cellular Membrane* under the Skin cannot be preserved distended with Air, except where there is little or no Fat contained in it. One of the best Parts for making a Preparation of this Kind is the *Scrotum*, where what is commonly called *Musculus Dartos*, may, by blowing into it, be changed entirely into fine membranous Cellules; and *Carolus Stephanus* (a) very well

(a) De diffict. part. corp. human. lib. 2. cap. 2.

well observed, that the cellular Substance any where else under the Skin puts on a muscular Appearance when the Fat is wasted. Will not these Observations serve as some Apology for former Anatomists who reckoned a *Tunica carnosæ* among the common Teguments of the Body? May not we hence see one Reason of old emaciated People having so many Wrinkles in their Skin?

That the DURA MATER with all its Processes may be preserved in a natural Situation, it is necessary to saw the *Cranium* from near the Root of the Nose to the Middle of the *Os occipitis*, by a perpendicular Section at half an Inch distance from the sagittal Suture, and then by a horizontal Section terminating at the Extremities of the former perpendicular Section, to take off a considerable Share of the Side of the *Cranium*. After which the bar'd Part of the *Dura Mater* being cut by an Incision in Form of a T, the Brain and *Cerebellum* are taken out, and the Head is put amongst a Liquor to preserve it; or the Bones are made clean and exposed to the Air to dry, taking care to keep the cut Parts of the *Dura Mater* stretched out with Pins, Hooks or Threads. If the Head of a Fœtus, or of a very young Child, is thus to

be dried, the ligamentous Membranes between the Bones must be kept extended by Sticks cut of such a Length, as when put into the Cavity of the *Cranium*, their Extremities may rest on the Bones, and push them outwards.

The Processes of the *PIA MATER* which are placed in the Interstices of the Convolutions of the Brain, may be easily separated entire with the *Pia Mater*, when that Membrane is preternaturally thickened by Diseases, as it frequently is: And even in a sound State, large Pieces of it may be got with its Processes, after macerating the Brain in Water. As soon as it is separated, and the Water pressed from it, it ought to be immersed in the embalming Liquor, where it is to be kept extended by Threads or small Branches of Plants.

The *BRAIN* requires no Preparation, except either for demonstrating its succous Vessels, the Method of doing which I have already mentioned; or for hardning it, which I shall afterwards speak of.

Before the Coats, Humors and Vessels of the *EYE* can be rightly prepared for preserving, so as to demonstrate all of them, it is necessary to coagulate the crystalline and vitreous Humors, by immersing the Eye for some Time in a proper Liquor; of which

which hereafter. After this they will bear Maceration in Water, for the Separation of the choroid and *Ruysch's* Coat.

The sebaceous Glands and Ducts of the Eye-lids appear much better after a subtile Injection of the Arteries, and the Coagulation of their Liquors, than in the recent Body.

Dr. *Trew* (a) has very justly observed, that by macerating the EAR in Water, the Membrane which is continued from the *Epidermis* of the Ear to line the *Meatus auditorius externus*, and to form the outer *Lamella* of the *Membrana Tympani*, may be brought off entire in Adults, as well as it is easily separated in Foetuses, or very young Children. And indeed the *Membrana Tympani* appears to be no other than this *Cuticula*, and the Membrane that lines the *Tympanum*, connected by a thin cellular Substance, in which, as in all other such Parts of the Body, the larger Branches of the Vessels run.

The *Epithelia* of the LIPS, as *Ruysch* calls the *Cuticula* covering the *Papillæ* there, is to be taken off by macerating in Water, which makes the Surface appear better in the villous Way, when the Lips

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are

(a) Act. Physico-medic. Acad. N. C. Vol. 2. Obs. 56.

are afterwards put into a Glass with the em^{balming} Liqueur.

The villous Substance of the TONGUE is very easily made quite red, with Injection thrown in by the Arteries, and a Membrane analogous to a *Cuticula* separates by soaking in Water; and upon comparing the Lips, Tongue, *Oesophagus*, Stomach and Intestines, the Structure seems to be so far alike in all, as they are covered with this sort of *Cuticula*, which is connected to the muscular Part by a cellular Substance, in which the numerous Nerves, Vessels and Glands are lodged. This cellular Substance either is formed into Ridges and Valves where it is thick and loose, or appears like a fine Membrane where it is thin and stretched.

There are no Organs in the Body, of which I find a greater Difficulty to give the Students of Anatomy a good Idea, than those employed in *Deglutition*. In the recent Body they cannot see them all at once in the natural Situation: They can scarce be held in a wet Preparation, so as to shew them well enough. What has the best Effect is to demonstrate the grosser Parts first in a dry Preparation, which requires Patience to execute right; for all the Muscles belonging to these Organs, that are fixed to
any

any of the surrounding Parts, must be all clean dissected, and then cut off from these surrounding Parts; after which the Tongue, *Os Hyoides*, *Fauces*, *Velum pendulum Palati*, with the *Uvula*, the *Larynx*, *Pharynx*, *Aspera Arteria* and *Oesophagus*, are taken out with the dissected Muscles hanging at them, to be all secured in their natural Situation with small Pieces of thin Boards, and Threads fastned to Hooks. A Cork is then put into the lower Part of the *Trachea*, round which and the *Oesophagus* a strong Thread is tied firmly, and Quick-silver is poured by the *Fauces*, or by the Passage which formerly led to the Nostrils, till the *Oesophagus*, *Trachea*, *Larynx* and *Pharynx* are filled; in which Condition it is allowed to hang till the Parts are pretty firm, but not near fully dry, when the Quick-silver is poured out, and the Parts overstretched by its Weight, such as the *Glottis* and Space between the Tongue and *Larynx*, are, by pressing and squeezing with the Fingers, to be brought near to the natural Situation; and others that shrivel too much, as for Instance the *Uvula* and *Epiglottis*, are kept near to the natural Form, by drawing and pressing them from Time to Time till they are fully dried.

The hollow VISCERA of the *Thorax*

and *Abdomen* are not only to have their Vessels demonstrated in the Ways mentioned formerly, when speaking of the Blood-vessels; but when they are to be kept dry, they require a particular Preparation for preserving their Form, and for shewing their interior Structure, which is to fill them with some proper Substance. The Properties I think this should have, are to be able to resist the shriveling Contraction of their Fibres, to fill them all equally, and to leave them clean if it should be taken out. For these Reasons, Cotton, Wool, Sand, or such like, are improper; all that I use is Air, Quick-silver, or melted Wax.

Wax is only to be employed where there is no farther Design than to view the exterior Surface, for which purpose it may be thrown into any of the hollow Bowels; but in all other Cases, Air or Quick-silver must be used.

Where Air will answer the Design, it is preferable to the Quick-silver, for it stretches every where equally; whereas Mercury presses most on the depending Parts. Air dries the Bowels in the twentieth Part of the Time that Quick-silver does, and it leaves no colouring or gilding on them; which the Mercury always does. On the other Hand, Air does not stretch some
Parts

Parts sufficiently, cannot be retained, and insensibly escapes so from others, as to allow them to collapse in drying; which Inconveniencies the Quick-silver is not so subject to.

From what has been said, it is evident that Air is required, or is much preferable to Quick-silver, for making dry Preparations of the *Oesophagus*, *Stomach*, *Guts*, *Vesica fellea* with the *biliary Ducts*, and *Bladder* of *Urine* with the *Ureters*. And it is as plain on the other Side, that the *Pericardium* and *Uterus* can only be kept distended in their natural Form with Mercury.— The Heart with its Blood-vessels, and the *Pelvis* of the Kidney with the *Ureter*, generally have some small Passages for the Air to escape at, and it scarce can resist the shriveling Contraction of their Fibres; wherefore Mercury is preferable in drying them. The *Corpora cavernosa* of the *Penis* and the *Vesiculæ seminales* retain both Air and Mercury; but this last leaves a Gilding in the *Corpora cavernosa*, which hinders such a clear View, as could be wished, of their Vessels and Texture; and there is a Difficulty to fill the *Vesiculæ seminales* with it, for the Orifices at the *Caput Galinaginis* will not admit it from the *Urethra*; and when it is poured in at the *Vas deferens*

deferens, the Moisture of this narrow Pipe is liable to stop it ; and after you have got it to run in this Canal, its Weight forces open the Orifice into the *Urethra* of the small Duct common to the *Vas deferens* and *Vesicula seminalis*, so that it will not mount into the *Vesicula* till the *Urethra* is filled ; Whereas the Contraction of that Orifice resists a small blast of Air, which readily regurgitates into the *Vesicula*. For which Reasons Air is preferable for the *Corpora cavernosa* and *Vesiculæ seminales*. ---It is seldom we meet with Subjects whose *Lungs* or *Spleen* will retain Air, and the *Glans* of the *Penis* is very liable to allow it to escape ; Wherefore generally we are obliged to make use of Quick-silver for these Parts : Which however does considerable Prejudice in all of them, but especially in the *Lungs* and *Glans*, whose Cellules are smaller than those of the *Spleen*.

Being determined by the foregoing Rules which of the two Liquors to use, we press out all the Blood or other Liquors contained in the Bowels we design to fill, and then tie all the Passages from them, except the one by which we are to introduce the distending Liquor ; and in case we discover any others in the Time of filling them, at
which

which the Air or Quick-silver escapes, we tie it likewise.

The Passage by which the Liquors should be introduced, is to be chosen such as soonest allows them to pass every where into the Cavity to be filled, and that is most easily secured afterwards. What was said of the Organs of Deglutition will readily lead one to know how to distend the *Pericardium* and *Uterus*. The Place for blowing up the alimentary Tube, *Vesica fellea* and *urinaria*, is known to every body. Liquors are poured into the Heart and large Arteries through the superior *Vena cava*, and any Branch of the pulmonary Veins. The *Trachea Arteria* receives what the Lungs are to be distended with. The Kidney is to be filled by the *Ureter*. The Veins of the Spleen, *Capsula atrabilaris* and *Corpora cavernosa Penis*, are to convey the Substance with which they are distended..

We must always make use of a Pipe, when we are to blow up any Part. The best sort of Pipe for this Use, is what has a small Extremity, with a Notch round it, and a Stopcock a little higher in it. We introduce the small Extremity into the proper Canal which is tied upon it with a waxed Thread, that is made to sink into the Notch; and
as soon

as soon as the Bowel is sufficiently distended, the Stop-cock is turned, to prevent the Air to get out. If any of it should escape, it is easily supplied by a new Blast at the Pipe, which is supported by some String or Board to hinder it to press or draw the Preparation while it is drying.— If the Anatomist is provided with no other than a common Blow-pipe, the Canal by which the Air is introduced, must be tied tight upon it with a thread, which is drawn with a firm Knot by an Assistant, while the Air is blown in. As soon as the Bowel is sufficiently distended, a Signal is given to the Assistant for pulling the Ends of the Thread, while the Pipe is drawn out of the Canal, and immediately another Knot being made, the Preparation is suspended by this Thread.

When Quick-silver is employed, the Passage by which it is poured, must be higher than any other Part of the Preparation; and when that Passage is narrow, a small Glass Funnel or Pipe must be put into it. This Pipe must be long, where the Weight of a high Column of Mercury is wanted to make it run through small Vessels. If the Preparation will allow, the Passage by which the Mercury entered is to be tied firmly, otherwise, before any Mercury is poured in, that Passage must be secured, so

as to remain uppermost, all the Time the Preparation is drying.—When a considerable Quantity of Mercury is poured into any Part whose Texture is tender, it is necessary not only to suspend it with Threads and Hooks in the superior Part, but to support it also by a small Net extended below it, upon a proper Vessel for receiving the Quick-silver, if by any Accident it should run out.

The Directions now given will serve for preparing the most Part of the Bowels; but the LUNGS and SPLEEN, whose Membranes very difficultly retain either Quick-silver or Air, especially this last, require more Care. These Bowels must not be taken indifferently from any Subject; but such must be chosen as have the exterior Membrane thick and strong. After they have been distended as above directed, they should be exposed to the warm Sun, or near a Fire to dry them soon, returning frequently to supply by a new Blast what they lose in very little Time. As soon as their outer Surface is dry, immerse them into strong *Turpentine Varnish*, so as their whole Surface may be covered, after which they will retain the Air much better; continue to place them so that they may soonest dry, taking care to rub on Varnish with

a Feather, wherever it is wanting, and to blow in new Air whenever they subside.

After the human *Spleen* has been kept distended with Quick-silver or Air till it is dried; it seems to be wholly composed of Cells communicating with each other, upon the Sides of which the small Branches of the Artery are observed to spread in great Numbers, if they have been previously injected, as you may see when you please in several such Preparations now in my Possession.

Upon cutting the *Lungs* thus prepared, their Vesicles appear far from being Spheres, or any other Figure whose transverse Section is circular, for they evidently are Polygons, generally irregular Squares and Pentagons. And indeed one might conclude *à priori*, that they are rather more so in a living Creature; for seeing the exterior Membrane is of a firmer Texture than the Vesicles, and will not stretch out so far as they could be extended, they must push violently on each other, and therefore be pressed from a spherical Form, into as many Sides and Angles as there are contiguous Vesicles; and the *Thorax* of a living Creature does not allow the Lungs to be extended so far as their exterior Membrane can be stretched, as is evident from their starting
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ing out at Wounds of the *Thorax*, or by blowing into the *Trachea Arteria*, after the *Sternum* of a Creature is taken away; and therefore their Vesicles must be more compressed, and consequently their Sides be straighter in Respiration, than when they are distended, after being taken out of the Body. These Considerations, and the obvious Polygon Form of the Cells in the simple Lungs of Serpents, Frogs, &c. makes me surpris'd that ever the Vesicles of more complicated Lungs should have been imagined to be Spheres, or any other Figure, whose transverse Section is circular.

I come now to consider the Manner of preserving Preparations, which is either by exposing them to the Air till all their Moisture is evaporated, and they become dry, rigid, and out of Hazard of corrupting; or by immersing them in a proper Liquor. Besides what has been already said concerning the Manner of drying Preparations, it is also necessary, especially when the Parts are thick and bulky, and the Weather is warm, to guard further against Putrefaction, to hinder Flies to lay their Eggs upon them, which soon growing into Maggots would destroy them, and to prevent Insects,

sects, Mice or Rats to feed on them. All this may be done by soaking the Preparation, some Time before it is exposed to dry, in a Solution of corrosive Mercury in Spirit of Wine. The Proportions I use, are two Drachms of the Corrosive to a Pound of the Spirit; and while it is drying, it is to be moisten'd frequently with the same Liquor. By this Method one can, without any of the Dangers above-mentioned, dry the dissected Bodies of pretty large Children in the midst of Summer, which sooner answers the Design, than the cold Moisture of Winter can.---- After the Preparation is dry, it is still liable to moulder away, become brittle, crack, and have an unequal Surface; wherefore it is necessary to defend all its Surface with a thick Varnish, with which it is to be covered over as often as the Lustre of the former Application wears off, and it must always be kept well from all Dust and Moisture.

Dry Preparations are very useful in several Cases, but there are a great many where it is necessary the Parts should be flexible, and nearer a natural State, than the Shriveling and Rigidity in this way of preparing can allow; the Difficulty has hitherto been to find a Liquor that would preserve them

them so near to a natural Condition. Watery Liquors do not prevent the Putrefaction, and dissolve the hardest Parts of the Body. Acids prevent Putrefaction, but dissolve the Parts into a Mucilage. Ardent Spirits harden the Parts, change their Colour, and destroy the red Colour of the injected Vessels. Oil of Turpentine, besides the Faults of the ardent Spirits, becomes thick and viscous. But without dwelling longer on the faulty Liquors, I shall inform you, That what I have always found to answer best, is a rectified ardent Spirit, no Matter whether from Wine or Malt, that is still limpid, without having any yellow Tincture, to which a small Quantity of a fossil acid Spirit, such as that of *Vitriol* or *Nitre*, is added; both of them resist Putrefaction, and what might be looked on as Faults, if each was considered single, is mended by the other. When these are mixed in a right Proportion, the compound Liquor changes neither the Colour nor Consistency of the Parts, except where there are serous or mucous Liquors, which it hardens much in the Way that boiling Water does. The Brain even of a new born Child is made so firm by it, as it can be handled with great Freedom. The crystalline and vitreous Humours of the Eye
I become

become firm, but white and opack, by soaking in it. The Liquor of sebaceous Glands, of mucous *Folliculi*, the Seed, &c. are coagulated by it. The lymphatick, or watery Liquors, such as the aqueous Humour of the Eye, Water of the *Pericardium* and *Amnios* are not changed by it. It heightens the red Colour of injected Liquors so much, that Vessels, which did not at first appear, are plainly seen, after the Part has been in it some Time. If you'll compare these Effects with what *Ruyfch* has said here and there of his Preparations, you'll find that the Liquor described comes pretty much up to the Properties of his Balsam, as he calls the Liquor in which he preserved his wet Preparations.

The Proportion of the Acid to be mixed with the ardent Spirit, is to be varied according to the Part to be immersed in it, and the Design the Anatomist has. When the Brain, Humours of the Eye, &c. are to be coagulated, a larger Proportion of Acid is necessary, such is, two Drachms of Spirit of *Nitre* to a Pound of *Alcohol*. When the Parts are only to be preserved, especially if there are any Bones in the Preparation, forty, thirty or fewer Drops of the Acid will be sufficient. If too large a Proportion of the Acid is mixed, the Bones
become

become first flexible, and then dissolve.

After any Part is embalmed, particular Care must be taken to keep it always covered with the Liquor, otherwise its Colour spoils, and some Parts harden, others dissolve. To prevent therefore the Evaporation as much as possible, and to exclude the Air, which makes the Spirits extract a Tincture, the Mouth of the Glass is to be carefully stopped with a Glass or a waxed Cork, Cover or Stopper ; over which Leaf-tin, a Bladder, or injected Membrane is tied, in which Way it will keep a considerable time without any great Waste. Whenever the Spirits sink near to the Top of the Preparation, more of the Spirit of Wine must be added, without the Acid, which flies little off. If at any Time the Spirits acquire too high a Tincture, they must be poured off, and new Spirits, with a less Proportion of the Acid than at first, must be put in their Place, the old ones being kept in a well corked Bottle, for washing away the natural Liquors of any new Preparation, which ought always to be carefully done before any Part is embalmed, and the old tintured Spirits are likewise to be washed off, with a small Quantity of limpid Spirits, every Time the old ones are renewed, or a new Preparati-

on is to be preserved. The Spirits unfit to be longer shewn in Glasses, may also be still employed in preserving Parts in earthen Vessels or Glass ones, out of which the Preparation must be taken when it is to be viewed.

It may not be amiss to remark here, That the Glasses in which Preparations are to be demonstrated, ought to be of the finest most transparent thick Kind, for these allow the Parts to be seen most distinctly, without changing their Colour, and at the same Time magnify the Objects, discovering Parts, which, when they are out of the Glass, could not be seen with the naked Eye. Since then the Glass with the Liquor has a certain *Focus*, where Objects are seen most distinctly, it will be necessary to use some Contrivance for keeping the Preparation at the proper Distance from the Side of the Glass; which may be done by putting in a small Branch of some Plant, or a little Stick, or by fastning the Thread or Hair by which the Preparation is suspended, towards one Side of the Glass. Such little Arts for keeping the Parts expanded, or placing them so as to be seen to the best Advantage, will easily occur to any who practices Anatomy.

I shall finish this Essay with a Caution to
Ana-

Anatomists to shun as much as possible putting their Fingers into this acidulated Spirits, or handling the Preparations that are very wet with them; for they bring such a Numness on the Skin for some Time, that makes the Fingers unfit for any nice Dissection. The best Cure I have used for this Numness, is washing the Hands with Water, into which a few Gutts of *Ol. Tartar. per deliquium* have been dropped.



XI. *Some Thoughts concerning the Production of animal Heat, and the Divarications of the Vascular System, being an Abstract from a Latin Treatise, of the Heat of Animals; In a Letter to Dr. JOHN STEVENSON Physician in Edinburgh, from Dr. GEORGE MARTIN Physician in St. Andrew's.*

S I R,

I Cannot but acknowledge the Pleasure I had from the good Opinion you conceived of my Treatise, *de calore animalium*. The Objections you was pleased to propole against it, gave me full Proof you had condescended to read and consider it carefully;

and at the same time gave me an Opportunity, if not to obviate them entirely, at least to render the Scheme somewhat less exceptionable. You think it would be of Use to the World, and wish it were made publick: But I do not yet think it finished; and I know not if any Works of mine shall ever arrive at that Degree of Perfection, as to be able to bear the Light, and face the Publick by themselves. In the mean time, in Compliance with your Desire, which I shall always very much regard, I will make a short Extract of some of the most material Things of it, which, after revising, you may dispose of in any way you think proper.

I need not say much concerning the Universality of this Property of *Heat*, whereof all Animals, while in Life, have a considerable Share. Nor is it necessary to recount the Sentiments or Mistakes of others about it: It may suffice to declare my Assent in general to the Opinion now most commonly received, *That the Heat of Animals is produced by the Motion of the Blood in the Vascular System.*

2. Nor does it seem to owe its Origin to any intestine Motion of the Particles of the flowing Blood. When I view the Circulation

tion in the small pellucid Vessels of Animals, I see no intestine Confusion of Particles; nor can I perceive any Motion fit for the Production of animal Heat, except the progressive Course of the Blood pressing and rubbing upon the Sides of the Vessels.

3. Nay I am afraid that even this Motion of the Blood, however rapid in the great Trunks, will in the minute Vessels be deemed too small and inconsiderable to produce an Attrition sufficient for the generating any sensible Heat: So that it may be thought necessary to have Recourse to chemical Principles; and to suppose Heat to be a sort of animal Process producing a certain Change in the Aliments, some way analogous to the *Luëtas* and *Effervescencies* we observe many other Bodies, in certain Cases, to undergo.

4. But it was just now remarked, that we could not perceive any violent intestine Motion of the Particles of the Blood, visible in the ordinary heating Effervescencies. And beside, in direct Confirmation of the mechanical Force of the Attrition of the Fluids on the Sides of the containing Vessels, from medical Observations we find, in the various Circumstances of the human

I 4

Body,

Body, the Heat generally in some sort to correspond to the Degree of Motion of the Blood. And above all, I hope I shall be able to make it appear, that the vascular System is so admirably contrived, and the various Motions of the Blood so skilfully adjusted by the great and wise Author of Nature, that, bating external Influences or Disturbances, the Heat of the circulating Fluids generated by Attrition, is every where preserved nearly uniform, with however differing Celerities they be propelled in different Parts of the animal Machine.

5. In order to the clearing and settling of this, I must premise a general Supposition, *That the Intensity of Heat generated by Attrition is, cæteris paribus, in Proportion to the relative Celerity, wherewith the Bodies rub against one another.*

6. And therefore if a Liquor be forcibly propelled through a Canal, *the Quantity of Attrition of the Liquor upon the Sides of the Canal generating Heat, is in a compound ratio of the Celerity of the Liquor (C), and of the Circumference (or Diameter D) of a Section of the Canal; that is, always as $C \times D$.*

7. When

7. When a Liquor moves through a Canal, its Particles, tho' they have no brisk intestine Motion, are frequently, however slowly, shifting Places. Whence we are to conceive the Quantity of Attrition around the Circumference of a Section, as equably diffused through the whole Section, so as to render the Heat in every Point of it from the Circumference to the Center perfectly uniform: And therefore *the real Intensity of Heat in such a Section is found to be as the Quantity of Attrition ($C \times D$) applied to (Z) the Area of the Section, or as $\frac{C \times D}{Z}$; that is as $(\frac{C \times D}{D^2})$ the Velocity of the Liquor, and the Diameter of the Canal directly, and the Square of that Diameter reciprocally. Which comes out as $(\frac{C}{D})$ the Velocity of the Liquor applied to the Diameter of the Canal.*

8. And from this it easily follows, *that if Liquors be propelled with Celerities proportional to the Diameters of their containing Canals, the Heat of these Liquors generated by Attrition shall be equal.* For D, d being the Diameters of the Canals proportional to C, c the Celerities of the propelled Liquors; in this Case $C \dots c :: D \dots d$, and therefore $C \dots D :: c \dots d$; and
con-

consequently $\frac{C}{D} = \frac{c}{d}$; that is, the respective Intensities of Heat are equal.

9. *If a Canal carrying a Liquor be ramified into Branches, the Heat of the Liquor generated by the lateral Attrition may be constantly equal; or may be increased or diminished in its Progress through this ramified System of Vessels, according to the Method of its Divarication, or the Proportion that the Wideness of the Branches bears to the Wideness of the Trunks from whence they arise.*

For the Heat of the propelled Liquor generated by Attrition, is every where as its Celerity applied to the Diameter of the Canal through which it is carried; so that, if, in the Divarication of a Canal, the Branches have always such a Situation and Largeness with respect to the Trunk from whence they arise, that the Velocities of the Liquor moving through them shall always correspond to their Diameters, then the Heat generated by Attrition shall be constantly equal.

But if the Largeness of the Branches be so adapted to the Capacity of the Trunks, that the Velocity of the Liquor flowing in them shall be greater, equal, or even but nearly equal to that in the Trunks, then
the

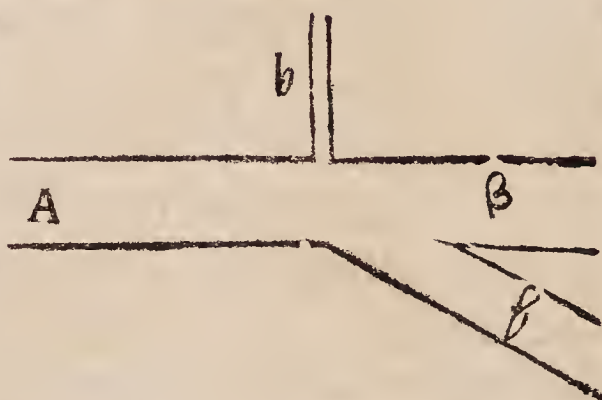
the Heat of the Liquor generated by Attrition, would be constantly increasing in its Progress through this supposed ramified System, and that, *cæteris paribus*, in a reciprocal Proportion of the Diameters of the Canals.

And on the other hand, if the Capacities of all the Branches put together should be vastly greater than the Largeness of the Trunk from whence they arise, so as to diminish the Velocities of the Liquor in a greater Proportion than the Diameters of the Canals; then indeed the Heat in such a System would be constantly on the Decay.

10. It seems to be the first of these Cases which actually obtains in the animal Machine. For though the Ancients made a great Ado about the various Degrees of Heat of the different Parts of the human Body; yet some of the best and most careful Observers amongst the Moderns, by Methods more certain and regular, than what the others were Masters of, have been assured that they are all nearly of the same Degree of Heat, when left to themselves in a sound State, and sufficiently defended from the Injuries of the Air, or external Cold; which I have confirmed by a thousand Experiments: And therefore it behoves

- hoves us to enquire more narrowly into the Nature of such a Divarication, which may render the Velocity of the Blood always in Proportion to the Diameters of its containing Canals, and consequently give it a Heat constantly equal.

II. Suppose any Artery A to be divided into what number of Branches b , β , β , you please, equal, or however unequal,



whose Diameters we call d , δ , δ , the Diameter of the Trunk A being D : So that their respective Orifices shall be proportional to D^2 , d^2 , δ^2 , δ^2 ; while the Celerities C , c , κ , k , wherewith the Blood is supposed to flow through these Vessels, are required to be proportional to the foresaid Diameters D , d , δ , δ respectively.

Now in the Divarication of any Artery, the Blood would flow into the several Branches with the same, or nearly the same Celerity, if they all rose with the same Obliquity to the Trunk from whence they spring. Therefore it seems necessary, for the due ballancing of the Velocity, to contrive the Divarication in such a manner, that

that the larger Branches shall always ly in a directer Course, and the smaller ones in a more inclined one to the Current in the Trunk, that the Quantities of the Blood flowing into them may be in a greater *Ratio* than their Orifices would otherwise receive; so too that it may flow through them with the requisite Velocities proportional to their Diameters.

12. Thus then the Position of the Branches being settled, we come next to enquire what Proportion the Amplitude or Orifice of the Trunk must have to the conjunct Amplitudes of the Branches, so likewise as to preserve the above-mentioned Ballance of Celerity. In which Enquiry, in the first place, we are to observe that, universally, the Quantities of Liquor passing equably in a given Time through any Canals, are in a compound *Ratio* of the Amplitudes of the Canals, and of the Velocities of the Liquor conjunctly. Hence then the Quantities of Blood passing in a given Time through the Branches b, β, β , are as $d^2 \times c$, $d^2 \times \alpha$, $d^2 \times k$ respectively; to all which Quantities, the Quantity furnished them by the Trunk A, or passing through the Trunk in the same Time must be equal, and as $D^2 \times C$. That is then $D^2 \times C = d^2 \times c$

$$+ d^2$$

+ $\delta^2 \times x$ + $\gamma^2 \times k$. And therefore in the present Case (the Celerities C, c, x, k being supposed proportional to the Diameters D, d, δ, γ) $D^3 \times D$ shall be equal to $d^2 \times d$ + $\delta^2 \times \delta$ + $\gamma^2 \times \gamma$; or $D^3 = d^3 + \delta^3 + \gamma^3$. That is, *the Cube of the Diameter of the Trunk is equal to the Cubes of the Diameters of all its Branches added together.* And so D is equal to $\sqrt[3]{d^3 + \delta^3 + \gamma^3}$; that is, *the Diameter of the Trunk is equal to the Cube-root of the conjunct Cubes of the Diameters of all the Branches.*

From whence, if once we know what Proportion the Branches have to one another, we can for certain determine what *Ratio* they, when put together, must have to the Trunk from whence they arise. Which was the Thing proposed to be found out concerning the Nature of that Divarication, where the Celerities of the flowing Liquor are supposed always proportional to the Diameters of the containing Canals.

13. To illustrate this Doctrine of *the Proportions of the Trunks and Branches* of a System of Vessels ramified according to the proposed Law of Divarication, for preserving the Velocities of the contained Liquor in a constant *Ratio* to the Diameters of its containing Canals, and so to maintain

a constant uniform Degree of Heat, let us try the Result of it in two or three familiar Examples.

If a Trunk should divide itself into two equal Branches, whose Orifices shall be to one another, as 1 to 1, and their Diameters in like manner to $\sqrt[2]{1}$ and $\sqrt[2]{1}$, or 1 and 1; then, by the general Proposition § 12, the Diameter of the Trunk is proportional to $\sqrt[3]{1^3 + 1^3} = \sqrt[3]{2} = 1'2599$; and consequently its Orifice must be $1'^{2599^2} = 1'5874$. So that the Amplitude of the Trunk is to the conjunct Amplitudes of the Branches as $1'5874$ to $1 + 1 = 2$; or as 100 to $125'99$.

Suppose a Trunk divided into two, however unequal Branches, which, for Example, should be to one another as 2 to 1; so that the Diameter of the greater Branch shall be proportional to $\sqrt[2]{2} = 1'4141$, that of the lesser as $\sqrt[2]{1} = 1$. Then the Diameter of the Trunk is proportional $\sqrt[3]{1'^{4141^3} + 1^3} = 1'5644$; and its real Largeness, compared to the Branches 2 and 1, shall be $1'5644^2 = 2'4473$. So that this Amplitude of the Trunk, being to the joint Amplitudes of the Branches as $2'4473$ to $2 + 1 = 3$, shall be to them likewise in the *Ratio* of 100 to $122'586$.

But should the Divarication be more complex, so that there be three, and these very

ry unequal Branches, in the *Ratio* perhaps of 3, 2, 1; whose Diameters therefore must be proportional to $\sqrt[2]{3} = 1.73205$, $\sqrt[2]{2} = 1.4141$, and $\sqrt[2]{1} = 1$: Then the Diameter of the Trunk comes out proportional to $\sqrt[3]{1.73205^3 + 1.4141^3 + 1^3} = \sqrt[3]{9.02395} = 2.0819$, the Square whereof is 4.3344 . Whence we find the Trunk to be to the Sum of the Branches put together as 4.3344 to $3 + 2 + 1 = 6$; that is as 100 to 138.42 .

14. I observed before, § 10, that the Heat in different Parts of the Body, in a natural and sound State, was every where nearly equal. And now having determined the Laws of the Divarication of a ramified System of Canals wherein the Heat generated by Attrition should be constantly uniform; let us in the next place enquire if these Laws obtain in Fact; and if Anatomy and a true Mensuration of the Vessels of the human Body do in reality correspond to our Theory.

It is obvious at first Sight, and every body may have observed, that the Position of the Vessels entirely favours our Scheme. Is it not manifest, as it has been sometimes very justly remarked, that the greatest Vessels ly more directly in the Way of the Trunks

Trunks from whence they arise, while the small ones rise at very great Inclinations according to their various Sizes? (the like whereof may in some measure be observed even in the Ramifications of Trees and other Vegetables.) From whence the Blood, flowing more freely into the greater Branches, must likewise pass through them with a proportionably greater Velocity, than through the minuter Vessels, which give not such an advantageous Ingress to the protruded Fluid.

15. The next Thing we are to consider is the Size of the Vessels, or the Proportions of the Branches to their furnishing Trunks. It is very difficult, if not impossible, to survey the Vessels of Animals with a mathematical Exactness, so as to find them always observing the same Rule. In measuring an Artery, for Example, a Line broad, who will undertake never to err $\frac{1}{200}$ Part of an Inch? And yet an Error so seemingly little, will lead us into a Mistake near $\frac{1}{8}$ of the Amplitude of the Vessel: So that the smallest unavoidable Errors in measuring shall occasion some seeming Deviations from the Rules that really Nature may have followed. And therefore I hope even the most scrupulous will be satisfied, if up-

on the strictest Examination it shall be found that Experience and our Theory, though not always jumping exactly in the same Numbers, are however, for the most part, very little wide of one another. Physical Experiments and practical Mechanicks allow only of an Approximation to Geometrical Demonstrations.

Now it has been observed in general by others, that the conjunct Amplitude of the Branches of Arteries are always larger than the Trunks from whence they arise; and consequently that the Blood, on this Account chiefly, suffers a vast Retardation in its Progress from the Heart to the extreme Parts of the Body: But we do not stop in this general Observation. From innumerable Measures and Experiments we moreover pretend to find a determined Proportion, and a very elegant Harmony in the Dilatation of the arterial System, and in the Retardation of the Blood moving through it; to wit, *That the Diameter of every Artery is equal to the Cube-root of the conjunct Cubes of the Diameters of all its Branches: And the Velocity of the Blood in the Arteries always in proportion to their several Diameters*; for the Preservation of an equable Degree of Heat through all this far extended System.

16. This, I say, we find from the nicest Examination of the Vessels that possibly can be made; the several Measures sometimes exceeding, sometimes not coming entirely up to the Rule; but by so little Differences, and these as often on the one Side as the other, that we cannot doubt of such small Variations having flowed from some overlooked Circumstance, or some inevitable Errors of Mensuration. Which is plain from the following very ample Collection of Experiments, wherein at one View we have the Proportions of the Trunks to the Branches, both according to the Theory, and according to the actual Measures that were taken of them, with the Differences in these two Circumstances. Which Differences are truly less than we could well have expected; and which would still have been but a half of what we have here set down, if we had made our Calculations of the Diameters, and not of the Amplitudes of the Vessels. And they are the Diameters which are primarily measured.

17. No body will blame me that I have, in Confirmation of this Doctrine, chosen to give other Folks Experiments rather than my own. Those are liable to no Objecti-

ons: The Authors of them could have no Prepossessions in favour of a Scheme they were not apprised of; which I acknowledge would be much more exceptionable, had I founded it only on my own Observations.

In the first place I have set down some Measures, taken with all the Care imaginable from the Anatomical Tables of *Eustachio*; who of all the Anatomists seems to have studied, with the greatest Accuracy, the Symmetry of the human Body, and the just Proportions of all its Parts. However that I may not conceal any the least material Circumstance from you, I must acknowledge, that, in comparing the Aorta with the Iliacks, I took it where it appears smallest in his Figures, which is a little below the Emulgents: Which Trunk, beside the Iliacks, gives off other Arteries, as some of the Lumbar, the inferior Mesenterick, and the *sacra*. But these, when taken in too, are not really of such Consideration as much to disturb or alter our Calculations.

18. Then follow some Measures taken from Professor *Ruyfch*'s Figures. His singular Art in injecting the Vessels, and the great Pains he took to have them accurately delineated, every body knows.

But

But since whatever Care *Eustachio* and *Ruysch* took, it must have been impossible to shun some small Deviations from Nature, both in painting and graving their Tables, (as we find some Variations in the same Figures repeated in different Tables of *Eustachio*) and that we likewise may not have measured them with absolute and perfect Exactness, you will not wonder that they do not precisely coincide with the Numbers of the Theory. However this still comes out as a Medium between them.

19. The Experiments we have borrowed from the ingenious Dr. *Keill* are liable to none of the Inconveniencies of painting. He measured the Vessels themselves; and therefore I have adopted all his Measures: Only some few I have omitted, which, for their being taken from too minute Vessels, could not be much relied on; and two or three more, which, by transgressing the necessary Laws of Ramifications, as omitting a Branch or two, or exhibiting a Branch greater than its furnishing Trunk, discover some Mistake to have crept into these Observations. On which Account, and for other like Reasons, I have neglected most of the ordinary Anatomical Figures: However even some of these I have now like-

wile added under the Title of *Miscellany Observations*; though I do not pretend to lay so much Stress on them, as upon the other Experiments I had first taken in, especially those of *Keill* and *Eustachio*.

20. That I might not seem to have neglected such Measures my self, for the greater Confirmation of the rest, if any thing of mine could add to their Authority, I have added some of my Observations too. And being unwilling to omit any thing of this kind, in transcribing this Paper, I have inserted two or three that the industrious Dr. *Nichols* has now furnished us; who, I find, has been at more than ordinary Pains in surveying the Vessels both of Animals and Vegetables.

21. And now follows the Collection II promised of the Experiments themselves, shewing *the Proportions of the Trunks to their Branches* in the Arterial System of the human Body.

The divaricated A R T E R I E S.

From *EUSTACHIO*.The right Subclavian Artery, divided into the Axillary }
and Carotid. *Tab. XVI. Fig. 1.*A Mesenterick Artery, the exactest Way I could take }
the Measures, *Tab. XI. Fig. 1.*A Mesenterick Artery in another Subject, *Tab. XXVII.* }
*Fig. 4.*The descending *Aorta* split into the } *Tab. XII. Fig. 1.*
two Iliacks } *Tab. I. Fig. 1.*The same in another Subject } *Tab. XII. Fig. 3.*
} *Tab. I. Fig. 2.*The same in another } *Tab. XII. Fig. 4.*
} *Tab. IV. Fig. 5.*The same in another } *Tab. XII. Fig. 7.*
} *Tab. I. Fig. 3.*The same in another } *Tab. XII. Fig. 9.*
} *Tab. III. Fig. 1.*The same in another } *Tab. XII. Fig. 10.*
} *Tab. III. Fig. 3.*The same in another } *Tab. XII. Fig. 12.*
} *Tab. III. Fig. 2.*The same in another, *Tab. II. Fig. 1.*The same in another, *Tab. II. Fig. 2.*The same in another, *Tab. II. Fig. 3.*The same in another, *Tab. XXV.*The same in a Woman, *Tab. XIII.*From *RUYSCH*.The Right Subclavian branched into the Axillary and }
Carotid. *Ep. Probl. III. Tab. III. f. 2.*Proportions
of the
Branches.Capacities of
the TrunksConjunct Ca-
pacities of all
the Branches.By the
Theo-
ryBy
measu-
ring.

Differences.

11 . 12

100

126

129

 $\frac{1}{42} +$

8 . 5

100

124

122

 $\frac{1}{62} -$

1 . 1

100

126

119

 $\frac{1}{13} -$

1 . 1

100

126

128

 $\frac{1}{63} +$

1 . 1

100

126

134

 $\frac{1}{16} +$

1 . 1

100

126

130

 $\frac{1}{12} +$

1 . 1

100

126

123

 $\frac{1}{12} -$

1 . 1

100

126

120

 $\frac{1}{21} -$

1 . 1

100

126

120

 $\frac{1}{21} -$

1 . 1

100

126

146

 $\frac{1}{6} +$

1 . 1

100

126

132

 $\frac{1}{21} +$

1 . 1

100

126

138

 $\frac{1}{11} +$

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126

136

 $\frac{1}{13} +$

1 . 1 q.p.

100

126

136

 $\frac{1}{13} +$

1 . 1 q.p.

100

126

123

 $\frac{1}{11} -$

1 . 1

100

126

114

 $\frac{1}{11} -$

1 . 1

100

126

110

 $\frac{1}{8} -$

1 . 1

100

126

131

 $\frac{1}{25} +$

1 . 1

100

126

138

 $\frac{1}{11} +$

1 . 1

100

126

133

 $\frac{1}{8} +$

1 . 1

100

126

121

 $\frac{1}{25} -$

1 . 1

100

126

124

 $\frac{1}{63} +$

2 . 1

100

123

136

 $\frac{1}{10} +$

The divaricated A R T E R I E S.

	Proportions of the Branches.	Capacities of the Trunks.	Conjunct Capacities of all the Branches.		Differences.
			By the Theo- ry.	By measu- ring.	
The superior Branch of the splenick Artery entring the Spleen, <i>Ep. Probl. IV. Tab. IV. Fig. 2.</i>	4 . 4 . 1	100	136	125	$\frac{1}{12}$ —
Its inferior Branch, <i>ibid.</i>	3 . 2	100	125	121	$\frac{1}{31}$ —
The uppermost Artery from this inferior Branch, <i>ibid.</i>	7 . 6	100	126	130	$\frac{1}{31}$ +
The lower one, <i>ibid.</i>	5 . 4	100	126	140	$\frac{1}{9}$ +
A Mesenterick Artery, <i>Mus. Anat. p. 76. Fig. 5.</i>	1 . 19.p.	100	126	128	$\frac{1}{63}$ +
Its right Branch, <i>ibid.</i>	10 . 99.p.	100	126	136	$\frac{1}{17}$ +
Its left Branch, <i>ibid.</i>	5 . 1	100	113	108	$\frac{1}{23}$ —
From <i>KEILL.</i>					
The superior Mesenterick Artery, spending itself in twen- ty one Branches, <i>Tent. IV. p. 88.</i>	2136. &c.	100	258	247	$\frac{1}{23}$ —
The 5th Branch of the Mesenterick, <i>ibid. p. 90. l. 15.</i>	5 . 8	100	124	102	$\frac{1}{6}$ —
The larger Branch of this 5th Mesenterick, <i>ibid. l. 25.</i>	5 . 9 . 8	100	142	150	$\frac{1}{18}$ +
The 3d Twig of this larger Branch, <i>p. 91. l. 4.</i>	4 . 39.p.	100	125	153	$\frac{1}{5}$ +
The 1st Branch of the 8th Mesenterick, <i>ibid. l. 12.</i>	1 . 1	100	126	118	$\frac{1}{18}$ —
The 2d Branch of the 8th Mesenterick, <i>ibid. l. 16.</i>	4 . 5	100	126	133	$\frac{1}{18}$ +
The 10th Mesenterick Artery, <i>ibid. l. 20.</i>	6 . 5	100	126	117	$\frac{1}{14}$ —
The first Branch of the 10th Mesenterick, <i>ibid. l. 24.</i>	5 . 6	100	126	123	$\frac{1}{12}$ —
The 2d Twig of this 1st Branch, <i>p. 92. l. 3.</i>	1 . 1	100	126	105	$\frac{1}{6}$ —
The 14th Mesenterick, <i>ibid. l. 7.</i>	1 . 1 . 1	100	146	144	$\frac{1}{73}$ —
The 15th Mesenterick, <i>ibid. l. 12.</i>	4 . 5	100	126	127	$\frac{1}{126}$ +
The 2d Branch of this 15th Mesenterick, <i>ibid. l. 16.</i>	7 . 6 . 6	100	144	156	$\frac{1}{12}$ +
One of the Twigs of this second Branch, <i>ibid. l. 21.</i>	3 . 4	100	125	137	$\frac{1}{10}$ +
The Femoral Artery dividing into two Branches, <i>Ten- tam. II. p. 45. l. 2.</i>	5 . 49.p.	100	126	157	$\frac{1}{4}$ +
Its 2d Branch, <i>ibid. l. 3.</i>	3 . 59.p.	100	124	113	$\frac{1}{11}$ —
The 2d Branch in <i>l. 3. ibid. l. 4.</i>	4 . 2 . 1	100	135	157	$\frac{1}{6}$ +
The 1st Branch in <i>l. 4. ibid. l. 5.</i>	2 . 1	100	123	136	$\frac{1}{10}$ +
The 2d Branch in <i>l. 5. ibid. l. 6.</i>	11 . 5	100	122	128	$\frac{1}{20}$ +

The

The divaricated A R T E R I E S.

	Proportions of the Branches.	Capacities of the Trunks	Conjunct Ca- pacities of all Branches.		Differences.
			By the heo- ry	By measu- ring.	
The first Branch in <i>l. 6. ibid. l. 7.</i>	5 . 3 . 1 <i>q.p.</i>	100	135	114 $\frac{1}{2}$	—
The 1st Branch in <i>l. 7. ibid. l. 8.</i>	3 . 2	100	124	124 0	—
The 1st Branch in <i>l. 1. ibid. l. 9.</i>	2 . 9	100	115	107 $\frac{1}{4}$	—
A Branch of the Femoral Artery in its Progress, <i>ibid. l. 10.</i>	3 . 2 . 30 <i>q.p.</i>	100	109	113 $\frac{1}{28}$	+
The 3d Branch in <i>l. 10. ibid. l. 11.</i>	1 . 5	100	113	112 $\frac{1}{113}$	+
The 1st Branch in <i>l. 13. ibid. l. 14.</i>	2 . 1	100	123	144 $\frac{1}{6}$	+
The 1st Branch in <i>l. 14. ibid. l. 15.</i>	5 . 6	100	126	120 $\frac{1}{21}$	—
The 2d Branch in <i>l. 9. ibid. l. 16.</i>	1 . 8 <i>q.p.</i>	100	109	87 $\frac{1}{4}$	—
The 2d Branch in <i>l. 16. ibid. l. 17.</i>	1 . 1 . 4	100	129	149 $\frac{1}{7}$	+
The 3d Branch in <i>l. 17. ibid. l. 18.</i>	3 . 2 . 30	100	109	109 0	—
The 2d Branch in <i>l. 5. ibid. l. 19.</i>	10 . 9	100	126	122 $\frac{1}{31}$	—

From my own Dissections.

The right Subclavian branched into the Axillary and } Carotid, in a Man,	3 . 2	100	125	111 $\frac{1}{9}$	—
The same in a Woman,	4 . 3	100	125	124 $\frac{1}{25}$	—
The same in a young Girl,	8 . 9	100	126	119 $\frac{1}{18}$	—
The Right Carotid, divided into the Internal and Exter- } nal in a Man,	3 . 2	100	125	127 $\frac{1}{63}$	+
The same in a Girl,	7 . 6	100	126	107 $\frac{1}{7}$	—
The <i>Aorta</i> ending in the Iliacs in a Boy,	1 . 1	100	126	106 $\frac{1}{6}$	—
The Iliack Artery branched into the External and Inter- } nal in a Man,	5 . 4	100	126	128 $\frac{1}{63}$	+
The same in a young Man,	5 . 4	100	126	130 $\frac{1}{32}$	+
The same in a Boy,	5 . 4	100	126	118 $\frac{1}{21}$	—
The same in another Boy,	5 . 4	100	126	130 $\frac{1}{32}$	+
The same in another Boy,	10 . 9	100	126	129 $\frac{1}{42}$	+
The same in a Woman,	1 . 1	100	126	124 $\frac{1}{63}$	—
The same in a young Girl,	5 . 4 <i>q.p.</i>	100	126	132 $\frac{1}{21}$	+
The same in another young Girl,	5 . 4	100	126	131 $\frac{1}{25}$	+

From

The divaricated A R T E R I E S.

54

Medical Essays

The divaricated A R T E R I E S.

	Proportions of the Branches.	Capacities of the Trunks.	Conjunct Ca- pacities of all the Branches. <div>By the Theo-ry. By measu-ring.</div>		Differences.
From <i>NICHOLS</i> .					
An Artery A (which I take to be one of the Mesentericks) } ramified into the Branches B, C. <i>Comp. Anat. Tab. II. p. 2.</i> }	3 . 4	100	125	113	$\frac{1}{11}$ —
The Branch C, divided into D, E. - - -	1 . 2	100	123	116	$\frac{1}{17}$ —
The Branch E divided into the smaller Branch 36, and a- } nother (Z.) which I find to be about 21, - - - }	5 . 3	100	124	116	$\frac{1}{15}$ —
The Branch (Z.) ramified into the Twigs 16 and 9, -	5 . 3 q.p.	100	124	119	$\frac{1}{25}$ —
<i>Miscellany Observations.</i>					
A Branch A of the External Carotid, divided into the an- } terior and posterior Branches C, B. <i>Du Verney Org.</i> }	5 . 3 q.p.	100	124	100	$\frac{1}{5}$ —
<i>de l'Ouie, Tab. II. Fig. 1.</i> - - - - - }					
The same, <i>ibid. Fig. 2.</i> - - - - -	4 . 3 q.p.	100	125	113	$\frac{1}{10}$ —
The anterior Branch, after throwing off D, subdivided in- } to two Branches, <i>ibid. Fig. 1.</i> - - - }	2 . 1 q.p.	100	123	133	$\frac{1}{12}$ +
The descending <i>Aorta</i> , ending in the inferior Mesenterick, } Lumbar and Iliacs, <i>Verbeyen. Anat. Tab. XVI. Fig. 1.</i> }	3. I. I. 40. 40 q. p.	100	132	134	$\frac{1}{80}$ +
The <i>Aorta</i> ending in the Iliacs, the inferior Mesenterick, } 4 Lumbar and 3 <i>Sacræ</i> , <i>Cowper Anat. hum. Bod. App.</i> }	23. 26. 2. I . I, &c.	100	140	124	$\frac{1}{5}$ —
<i>Tab. III.</i> - - - - - }					
The right Iliac into the External and Internal. <i>ibid.</i> -	I . I	100	126	106	$\frac{1}{6}$ —
The left Iliac divided in the same Way, <i>ibid.</i> -	I . I	100	126	105	$\frac{1}{6}$ —
The Cæliac into 2 Branches, <i>Cheselden Anat. Tab. XVII. 2.</i>	3 . 2 q.p.	100	125	132	$\frac{1}{18}$ +
The larger Branch of the Cæliac into lesser Branches, <i>ibid.</i>	9 . 9 . 5	100	142	144	$\frac{1}{71}$ +
The superior Mesenterick into three Branches, <i>ibid. 3.</i>	5 . 6 . I	100	129	130	$\frac{1}{123}$ +
The inferior Mesenterick divided into three Branches, <i>ib. 4.</i>	11. 20. 11	100	121	133	$\frac{1}{12}$ +
The descending <i>Aorta</i> ending in the Iliacs, <i>ibid. Tab. XV.</i>	I . I	100	126	121	$\frac{1}{25}$ —
The Cæliac Artery branching into the right and left, } <i>Stukeley of the Spleen, Tab. 1.</i> - - - }	9 . 10	100	126	105	$\frac{1}{6}$ —
A Capillary Artery of the Intestines sending off eight e- } qual Branches. <i>Hales Hæmestat. IX. 14. p. 53.</i> }	I. I. I. I. I. I. I. I	100	200	200	0

22. In this Collection there are indeed but few Observations which perfectly jump with the exact Proportions of the Theory: But many come very near them; and the Numbers of those coming short of it, and of those that exceed it, are nearly equal. And the common or middle Excess or Defect (reckoning one with another) is only about $\frac{1}{14}$ Part. Nay, in about ninety Observations, from the Excesses and Defects ballancing one another, the Sizes of the Branches determined by our Rules, and those found out by the most carefully made Experiments, come out almost exactly the same. The Odds being about $\frac{1}{600}$ or $\frac{1}{700}$ Part; a Quantity in such a Case to be esteemed as nothing. A surprising Coincidence! and which, before Trial, we durst not in such difficult and precarious Measures have expected or promised upon.

23. Seeing then these Observations quadrate so nicely to Theory, even more exactly than the most scrupulous would have required, I must acknowledge the very sensible Pleasure I had in perceiving this beautiful Harmony; and that I was exceedingly delighted to find (as I wished and expected) the Arteries of the human Body

to be distributed and divaricated in such a manner, both in their Position and Wide-
nels, that the Celerity of the Blood flow-
ing through them may be preserved in a
given Proportion to their Diameters; and
the same, or nearly the same Degree of
Heat generated by Attrition, continued
along the whole arterial System.

24. To obviate some Difficulties that might be started against us, we must observe, That, for the easier Reception of the Blood, the Artery is always a little wider in its Rise from the Trunk, from whence it converges in a conical Form: And that Arteries, considered as Trunks, just before they split into Branches, must be widened a little for the more convenient Divarication. So that if an Artery, from the beginning of its Rise to its Ramification into Branches, happen to be very short, it will commonly be found wider, and have a greater Proportion to its Branches than our Theory would require.

Thus, for Example, the great Trunk of the right Subclavian, before it divides into the Carotid and Axillary, is sometimes longer, and sometimes shorter. In the first Case, as in *Eustachio's Tab. XVI. Fig. 1.* or *Ruyseh's Epist. Probl. III. Tab. III. Fig.*

Fig. 2. it almost coincides with the Theory. In the second Case, as in *Ruysch's ibid. Fig. 3.* and *Cowper's Anat. hum. Bod. Append. Tab. III.* it differs so far from our Rules, as even to be much larger than the conjoined Branches which arise from it. Thus too the great Trunk of the *Aorta* being very short, and also curvated, is found to have a greater *Ratio* to its primary Branches, than otherwise we should have had Reason to expect: And so it seems *Valsalva (a)* reckoned it as a sort of *Sinus*. In which, and other like Cases, though we allow the Blood to have a slow Course through the Trunks, we need not be apprehensive of any Loss or Decay of Heat in such short Intervals: Which too may soon be sufficiently compensated by the subsequent more regularly adjusted Arteries; especially that the smaller Vessels do frequently, by Inosculations, communicate one with another; and so, beside other Uses, help to maintain a due and regular Balance of the Velocity of the circulating Fluids.

25. And, on the other Hand, for the like Reasons, we need not be afraid of the Heat being too much increased, though it should
move

(a) See Comment. Acad. Bonon. p. 376.

move something faster in the End, than in the Beginning of the long converging arterial Trunks, as in the Carotids or Iliacks; which run a good Space before their Divarication, without emitting any considerable Branches.

26. Contrary to what I alledged of the larger Branches rising more directly, and the small ones obliquely to the Course of the Blood, it will be said that some, even pretty large Vessels rise at an acute Angle from their Trunks in a retrograde Way; such as the umbilical Arteries in a *Fœtus*, or the Epigastricks from the external Iliacks. This I acknowledge one will be ready to think from inspecting the Figures in the common anatomical Tables. But every Body that is acquainted with Dissections, must have observed, that these Tables, either for the Convenience of Dissecting or Painting, or even sometimes by the Carelessness of the Authors, do very often exhibit Things far out of their natural Situation. And in this particular Case before us, if we will look into the Book of Nature itself, and examine Things as the great Author thereof has designed them, we shall find, that though such Vessels do carry the Blood in a Course directly contrary to its
Flux

Flux in the Trunks, yet their Rise is much in the same Angle with others of the like Size. Thus the Epigastrick Artery, instead of rising at an acute Angle, from the outer Side of the external Iliack, as *Vesalius* and the ordinary Tables represent it, does really spring from the inner Side of that Artery (as in *Cowper's Delineation ibid.*) at an Angle nearly a right one, but somewhat obtuse; and then forming an Arch, climbs upwards, carrying the Blood in a Course retrograde to what it was in before; which *Eustachio* (a) alone has taken care justly to represent, as he is the Anatomist in the World who has most carefully studied to exhibite all the Parts undisturbed, and in their due and regular Posture.

It remains now to apply our Rule of the Ramification of Vessels to some other Purposes in the animal Oeconomy; and to consider this Doctrine with respect to different Animals; and to enquire what Alterations of Heat, if any, their Difference of Magnitude will produce: How it may be influenced by any other Changes, whether in the Solids or Fluids, as by the Non-naturals, Age, Sex, &c. But all this would be diffi-

(a) Tab. Anat. Tab. XIII. XIV. Fig. 1. Tab. XXV. XXVII.
Fig. 12.

difficult to abridge; and to transcribe all, would carry me far beyond the Bounds I had fixed to my self at this Time.



XII. *An Essay concerning the Motions of our Eyes*; by WILLIAM PORTERFIELD, M. D. *Fellow of the College of Physicians at Edinburgh.*

PART I.

Of their External Motions.

THE Motions of the Eye are either external or internal. I call *external*, those Motions performed by its four straight and two oblique Muscles, whereby the whole Globe of the Eye changes its Situation or Direction. And by its *internal* Motions, I understand those Motions which only happen to some of its internal Parts, such as the *Crystalline* and *Iris*, or to the whole Eye, when it changes its spherical Figure, and becomes oblong or flat.

In this Paper I shall only treat of its *external Motions*, reserving the *internal Motions* for the far more fertile Subject of another

nother Essay, which I intend to send you hereafter, If I find that your Readers have any Relish for such Enquiries.

The spherical Figure of our Eyes, and their loose Connection to the Edge of the Orbit by the *Tunica conjunctiva*, which is soft, flexible and yielding, does excellently dispose them to be moved this or the other Way, according to the Situation of the Object we would view. This Membrane is from its Situation also called *Adnata*. It takes its Origin from the *Periosteum* all round the Edge of the Orbit, and is extended over the whole fore Part of the Globe, till its Termination in the Edge of the *Scleroticis*, where it joins the *Cornea*. It is called *Conjunctiva*, from its Office, *quia oculum cum capite conjungit*.

This Membrane is covered externally with another Membrane: For, as is known to Anatomists, the internal Membrane of the Eye-lids, at the Edge of the Orbit, is turned forwards upon the outward Face of the Eye, and is co-extended over it with the *Tunica conjunctiva*, to which it is adherent.

These two Membranes, because of their close Union, appear to be only one, and are generally described as such under the Name of *Membrana albuginea*, so called, because they

they form the *White* of the Eye, though in fact they are distinct Membranes, easily to be separated; the one a Continuation of the *Periosteum*, lining the Orbits internally, and the other of the inner Membrane of the Eye-lids. These Membranes, especially the external, are so full of Blood-vessels, and so laxly extended, that in violent *Ophthalmia's*, the *White* of the Eye is sometimes swelled so excessively, as to cover all the *Cornea*, which I here take Notice of, because it is ready not only to surprize, but to impose upon the unwary or unexperienced Oculist, as if it were an incurable Excrescence of the *Cornea* itself.

Besides these two Membranes, the fore Part of the Globe is covered all over externally with a very thin transparent *Apo-neurose* or *Surpeau*, which not only covers the Membrane which it has from the Eye-lids, but likewise is extended beyond it over the *Cornea* itself. The *Phlyectanæ* which are small transparent Vesicles full of clear Water, and which are frequently observed upon the Surface of the *Cornea* itself, as well as upon the *White* of the Eye, and even sometimes have their Center in some Part of that Circle of the *Cornea*, where it joins the *Sclerotis*, and by that means occupy at the same time both a Part
of

of the *White* of the Eye, and a Part of the *Cornea*, are, amongst other Things that might be advanced, a convincing Proof of the Existence of this *Surpeau*, and of its Extension over the whole *Cornea*.

It is by these Membranes that the Eye is connected to the Edge of the Orbit, which, being soft and flexible, they do in such a manner, as not in the least to impede its necessary Motions. And besides there is a great deal of Fat placed all round the Globe, betwixt it and the Orbit, which lubricates and softens the Eye, and renders its Motions more easy.

Now the *external Motions* of the Eye, are, as we before hinted, performed by means of six Muscles, whereof four are straight, and two oblique. *Gabriel Fallopius* (in his *Observationes anatomicæ*) is among the first that has given us a genuine Description of the Muscles of the Eye: For before him not only *Galen* but *Vesalius* himself has grossly erred in the Description of the oblique Muscles, and in assigning seven Muscles to the human Eye; on which Account *Realdus Columbus* (*de re anatom. lib. 5. c. 8.*) does indeed justly reprehend them, tho', at the same Time, he commits no less an Error himself, not only in supposing that the *obliquus inferior* begins and
ends

ends in the *Cornea* of the Eye, but also in imagining, contrary to what *Galen* and *Vesalius* teach, that the *obliquus superior* belongs to the Eye-lids.

The *First* of the four straight Muscles is situated upon the superior Part of the Globe upon which it lyes. It pulleth up the Eye when we look up, and is therefore called *Attollens* or *Superbus*, it being one of the chief Marks of a haughty Disposition to look high; wherefore its opposite Muscle is called *Humilis*. But *Casseri*us *Placentinus* thinks the Motion of the upper Eye-lids denotes these Dispositions more significantly; for, says he, (*lib. 5. cap. 18.*) *Qui enim hanc elatam habent* (speaking of the upper Eye-lids) *superbi & feroces sunt, qui vero depressam ac dimidium fere oculum cludentem, ita ut terram adspicere videantur, humiles & mites sunt.* For which Reason *Willis* (in his *anima brutorum, cap. 15.*) chuses rather to call them *Pii aut Devoti. Quia in precatione intensa, says he, oculum valde attollunt; quare Hypocritis, qui sanctitatis speciem affectant, in more est, oculum ita evolvere, ut albo fere tantum conspecto pupilla occultetur.*

The *Second*, as before hinted, is directly opposite to the *Attollens*, and is situated upon the under Part of the Eye which

it pulls down, and is therefore called *Deprimens* or *Humilis*.

The *Third* and *Fourth* are towards the Sides of the Eye, and draw it towards the Nose, or from it towards the little Angle. That which draws it towards the Nose is called *Adductor* or *Bibitorius*, because, in drinking, the Eyes are turned inwards to the great Angle for viewing the Drink. That which pulls it from the Nose towards the little Angle, is called *Abductor* or *Indignabundus*, because it is made use of in those lateral or squint Views that denote a scornful Resentment.

All these four Muscles arise from the Circumference of the Hole in the Bottom of the Orbit, through which the Optick Nerves pass; and advancing by the four Cardinal Parts of the Eye, terminate by four broad thin Tendons in the *Sclerotis*.

These Tendons form a large Aponeurose, which is spread over the outward Face of the Eye under the *Conjunctiva*, to which it also adheres and terminates at the Edge of the *Sclerotis*, where it forms the *Cornea*. *Columbus* pretends to be the first Discoverer of this Tunicle, to which he has given no Name. Hence it is frequently named *Tunica innominata Columbi*, tho' unjustly, because it was known to *Galen*,

as appears from the 2d and 8th Chapters of his 10th Book *de usu partium*. Others therefore with better Reason call it *Tunica Tendinea*, because formed of the Tendons of the four straight Muscles. *Aquapendent* is of Opinion, that the *White* of the Eye has its Colour from this Membrane: But the *Conjunctiva*, and the Tunicle which comes from the inner Membrane of the Eye-lids, do likewise concur, as has been demonstrated by *Plempius* (*Ophthalmographia lib. 1. cap. 8.*)

When the four straight Muscles of the Eye act separately, they pull the Globe up or down, to or from the Nose, according to the different Situation of Objects we would view. But when the *Superbus* and *Adductor* or *Abductor* act together, or when the *Humilis* and *Adductor* or *Abductor* act together, they perform the oblique Motions, which have been attributed to the oblique Muscles; and when all four act together, they draw the Eye inwards towards the Bottom of the Orbit, and keep it fixed in an equal Situation, which is therefore by Physicians called its *Tonick Motion*.

Some are likewise of Opinion, that when all these four Muscles act together, the Bulb of the Eye is compressed, and its *Axis*

is

is lengthned, when Objects are too near us; while others give them a quite contrary Action. But this we only mention by the Way, reserving it to be further considered when we come to examine the *inward Motions* of this Organ.

The oblique Muscles of the Eye are two in Number, whereof one is called *obliquus major* or *superior*, the other *obliquus minor* or *inferior*; they receive their Denomination from their oblique Position and Course.

The *obliquus major*, because of its length, is sometimes called *longissimus oculi*; it arises from the Edge of the Hole in the Bottom of the Orbit, that transmits the Optick Nerve, between the *Elevator* and *Adductor*, from whence it runs obliquely to the great *Canthus*: In the upper Part of which, near the Brink, there is a cartilaginous Ring or *Trochlea* affixed to the *Os frontis*, through which it passes its Tendon; from whence turning backwards, it is inserted into the *Tunica sclerotica*, towards the back Part of the Bulb of the Eye, in the middle of the Distance between the Termination of the *Attollens* and the Optick Nerve.

This *Trochlea* through which this Muscle passes its Tendon, was first discovered by the great *Fallopins*, who therefore justly

receives the Honour due to such a Discovery; though *Riolanus* does likewise ascribe it to his Cotemporary *Rondeletius*. From it sometimes the Muscle receives its Name, and is called *Trochlearis*: When it acts, it rolls the Eye about its *Axis* towards the Nose, and at the same time draws it forwards, and turns its Pupil downwards.

The second of these oblique Muscles, because of its being the shortest Muscle of the Eye, is frequently described under the Name of *brevissimus oculi*. It takes its Origin from the lower Part of the Orbit in its Inside near its Edge; and ascending obliquely by the outer Corner of the Eye, it is inserted into the *Sclerotis* near the Implantation of the former, directly betwixt the *Abducens* and Optick Nerve.

The Action of this Muscle is to roll the Eye about its *Axis* from the Nose, and at the same time to draw it forwards, and direct its Pupil upwards.

These two oblique Muscles are by some called *Circumagentes* and *Amatorii* (*Amoureux*) from their Actions in winding and rolling the Eye about, which Motions we call *Ogling*. But the French Academist *Mr. Perrault* (*du mouvement des yeux*) will not allow that the Eyes have ever any Motion round their *Axis*, because he could never

ver observe it in the Eyes of *Tortoises*, which have some fixed Spots that may serve for rendring such Motions obvious, but chiefly because he does not see what Advantage we could reap therefrom. But were Nature to be confined and limited in her Operations by our imperfect Views of the Advantages of her Actions, we should frequently deny the most evident Facts in the World.

But that *Perrault's* Authority may not mislead such as have not accurately observed the Origin, Progress and Insertion of these Muscles, it may be proper to observe that the learned Mr. *Mariotte* (in his *nouvelle decouverte touchant la vûe*) has demonstrated beyond Dispute, that that Part of the Bottom of our Eyes, where the Optick Nerves enter them, is insensible; and that the Rays of Light, which fall thereon, are entirely lost, without giving us any Idea of the Object from whence they came. Now our Optick Nerves enter the Eye, not in the Middle opposite to the Pupil, but a little on the Inside towards the Nose. Hence Objects placed a little on the Outside of the Optick *Axis*, if not over large, would be altogether invisible, because the Rays which come from them fall upon that insensible Part of the Bottom of our Eyes,

at which the Optick Nerves enter ; but, by the Circumrotation of our Eyes round their *Axis*, this insensible Part may be turned aside, and the Rays of Light which would have been lost, in falling upon it, may now, at least in Part, fall upon the sensible Part of our *Retina*; and therefore the Object, which otherwise would have been entirely invisible to that Eye, may at least in part become visible, which is a considerable Advantage, as every one must see.

I am not ignorant that there are many who have denied this oblique Insertion of our Optick Nerves. *Willis* and *Briggs* tell us, that not only in Man, but also in Dogs, Cats, and all the more sagacious Creatures, they enter the Globe at its *Axis* directly opposite to the *Pupilla*: But the Labour and Industry of later and more accurate Anatomists have long ago freed us from this Mistake; and though this Obliquity is considerably less in Man than in Oxen, Sheep, Swine, and the greatest Part of Birds and Fishes, yet no one who shall take the Pains to examine a human Eye, can miss observing it.

There are indeed some Creatures, such as the *Porcupine* and *Sea-Calf*, that have the optick Nerves inserted into the *Axis* of their Eyes: Which single Fact more effectually

ctually overturns *Mariotte's* Hypothesis of the *Choroides* being the principal and immediate Organ of Sight, than all the subtle Reasoning of *Messrs. Pecquet* and *Per-rault*, his greatest Opposers. Neither is it possible that this Defect in our Sight, where the optick Nerves enter, can arise from the Want of the *Choroides* in this Place, which according to *de la Hire's* Reasoning against *Mariotte* (See his Dissertation, *Sur les differens Accidens de la Vüe*) ought to receive the Impression from the Rays of Light (which, according to him, pass thro' the transparent *Retina*, without producing Vision) and communicate it to the *Retina*, with that Disposition and Modification which is proper for Sight, just as the spiral *Lamella* of the Ear receives the Impressions of the Air, to be communicated to the auditory Nerve, for exciting in the Mind the Idea of Sound. For were this true, then in these just now named Animals, all Objects would become invisible, to which their Eyes are directly turned, because the *Choroides* is wanting in that Place where their Image falls; which being contrary to Experience, it remains that some other Cause be assigned for that Defect of our Sight, than the Want of the *Choroides*. But to return.

Though the Action of these two oblique Muscles seems pretty evident, yet there is scarce any Part of the human Body about which Anatomists have differed more, than in assigning them their proper Offices. The famous Mr. *Cowper* is among the first I know who began to reason justly about them. But it would take up too much Time to enumerate and confute the several Opinions of different Authors; and therefore I shall content my self, after what has been already said of each Muscle acting apart, to consider what happens, when both act at the same Time.

Mr. *Cowper*, in his *Myotomia reformatæ*, has well observed, That when any of the straight Muscles act, they will rather draw the Eye inwards, within the Orbit, than turn it either sideways, or upwards, or downwards, were it not at the same Time drawn outwards by some equal Force. Now the above described Situation of these oblique Muscles, excellently qualifies them for keeping the Globe from being retracted, when any of its straight Muscles act; For by their joint Contraction they must pull the Eye outward from the Bottom of the Orbit, and keep it suspended as upon an *Axis*, for the better receiving the Motions of the straight Muscles: And this is
what

what we think the principal Use of its oblique Muscles, when acting together, seeing they combine both in this, while they are Antagonists to one another in their other Actions.

Aquapendent (in his Treatise, *de oculo*, cap. xi.) observes, That in the *Pike*, the oblique Muscles decussate one another in form of a Cross; and *Perrault* (*du mouvement des Yeux*) tells us, That they are both in the under Part of the Eye; and that because in such rapacious Animals, who frequently dive in pursuit of their Prey, they have Occasion more than others to turn their Eyes downwards. But this we chiefly take notice of, because it may afterwards be of some Use for determining how the Eye changes its Conformation, and adapts itself to the different Distances of Objects, which some have ascribed to the Action of those Muscles.

Cowper (in his *Myotomia reformatata*) quotes *Mullinete*, for describing a seventh Muscle, which he calls the fifth right Muscle, whose Office he confines to the Motion of the *Trochlea*. But, upon Examination, no such Muscle is to be found in the human Eye; and it is possible that *Mullinete* might be led into this Mistake, by that Part of the *Orbicularis palpebrarum*,

rum, which adheres to the *Trochlea*, or rather by what he might have observed in Dogs, who have a small Muscle arising near the Origin of the *Obliquus major*, and inserting itself by a very slender Tendon into the *Trochlea*, to whose Motions it is subservient, as *Douglas* observes (*Myographia comparata, cap. vi.*)

Besides these Muscles already described, Quadrupeds are provided with another, commonly called *Suspensorius*, from its assigned Use in suspending the Eyes of such Animals, as go much with their Head hanging down towards the Ground. This Muscle, among other Things, discovers that *Vesalius* has not been altogether free from a Fault, which he condemns very severely in *Galen*, to wit, the obtruding on us the Organs of Brutes, instead of those of the human Body, which he pretends to describe; for he has both described and painted it as belonging to Man, in whom it is never found.

This Muscle arises from the Circumference of the Hole in the Bottom of the Orbit through which the optick Nerve passes, and goes directly along the optick Nerve, which it embraces and surrounds on all Hands, and is inserted into the back Part of the *Sclerotis*, all round the optick Nerve,

Nerve, betwixt it and the Termination of the straight Muscles. Fishes and Fowls commonly want this Muscle, as well as Man; but Oxen, Horfe, Sheep, Hogs, and so far as has been observed, all Quadrupeds are provided therewith, tho, in all, it is not of the same Structure, being sometimes composed of two, three or four distinct Muscles, as *Aquapendent* (*de oculo, cap. xi.*) observes.

Aquapendent, *Willis* and *Briggs*, with the greatest part of our modern Anatomists, are of Opinion, that the only Use of this Muscle, is to draw the Eye inwards, towards the Bottom of the Orbit, and to keep it suspended, that when the Eye hangs down, as often happens in Quadrupeds, who gather their Food from the Ground, it may not fall too much out of the Orbit, or by its Weight stretch and fatigue the optick Nerve, to which it is attached. Hence they call it *Suspensorius*, as has been before observed. But this Action may in part be supplied by the straight Muscles acting together; and besides, a Ligament would have been sufficient for suspending the Eye; and therefore it is probable that this Muscle has some other Use.

Dr. Tyson finding this Muscle in the *Porpoise*, as well as in Quadrupeds, thinks its Use is not to suspend the Bulb of the Eye,
but

but rather by its equal Contraction of the *Sclerotis*, to which it is affixed, to render the Ball of the Eye more or less spherical, according to the different Distances of Objects, concerning which you may consult his Anatomy of the *Porpefs*, (p. 39.) But it is not absolutely certain that the Figure of the Eye can be changed by the Action of this Muscle, and that for Reasons afterwards to be mentioned, when we come to consider its internal Motions; and besides, the necessary Change of our Eyes is well provided for by another Mechanism, as will also appear in its proper Place.

I think therefore that the Use of this Muscle is not only to suspend the Eye, and preserve the optick Nerve from being too much stretched, but principally to assist the straight Muscles in moving the Eye, according as its different Fibres act, *e. g.* when its superior Fibres act, they assist the *Attollens* in pulling the Eye up; when its internal Fibres next the Nose act, they assist the *Adducens*; and when both together, or those betwixt them act, they pull the Eye obliquely upwards towards the Nose, and consequently assist the *Attollens* and *Adducens* in their joint Action of moving the Eye obliquely. Comparative Anatomy makes this Opinion very probable; for, in several

several Animals, as we have before hinted, it is divided into several distinct Muscles, whereof *Aquapendent* has observed sometimes three, and sometimes four in the Eyes of Sheep; and *Douglas* tells us, That in a Dog it is divided sometimes into four, and sometimes into five, which have as many distinct Insertions into the *Sclerotis*. Mr. *Perrault*'s Observation on this Muscle does likewise very much confirm this Opinion. (See his Treatise, *Du mouvement des Yeux*.) His Words translated are, “ In effect we may say, (speaking of this Muscle) that it contributes to the Action of the straight Muscles, according as its Fibres act differently, there being several Creatures, such as the Bear, Pole-cat, (*l'Ours, la Fouine*) and many others, where this Muscle is separated into four, having as many different Insertions, which being betwixt the Insertions of the four straight Muscles, may serve for the oblique Motions of the Eye, which in Man are chiefly performed by the Combination, or successive Action of the four straight Muscles.”

Having examined what belongs to the Mechanism of the *External Motions* of our Eyes, I shall now beg Leave to add some
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Reflections thereon, which I flatter myself will not be altogether unacceptable to some of your Readers. And

I. When Nature has denied the Head or Eyes any Motion, it is to be observed that she has with great Care and Industry provided for this Defect. Dr. *Power's* microscopical Observations furnish us with a beautiful Example of this: His Words are, (*Observat.* 8.) “ The first eminent Thing
 “ we found in the House-spiders were their
 “ Eyes, which in some were four, in some
 “ six, and in some eight, according to the
 “ Proportion of their Bulk and the Longi-
 “ ty of their Legs. These Eyes are placed
 “ all in the Forefront of their Head (which
 “ is round and without any Neck) all dia-
 “ phanous and transparent like a Locket of
 “ Diamonds, or a Set of round Crystal
 “ Beads, &c. Neither wonder why Pro-
 “ vidence should be so anomalous in this
 “ Animal more than in any other we know
 “ of, (*Argus's* Head being fixed to *A-*
 “ *rachne's* Shoulders:) For 1st, Since they,
 “ wanting a Neck, cannot move their
 “ Head, it is requisite that Defect should
 “ be supplied by the Multiplicity of Eyes.
 “ 2^{dly}, Since they were to live by catch-
 “ ing so nimble a Prey as a Fly is, they
 “ ought to see her every Way, and to take
 “ her

“ her *per saltum* (as they do) without any
“ Motion of their Head to discover her ;
“ which Motion would have scarred away
“ so timorous an Insect.

It is therefore with good Reason that *Muffet*, speaking of this *Lydian* Spinstress, that proud Madam, whom for her Rivalship the Fable makes *Pallas* transform into a Spider, says of those Philosophers that held them blind, *Sane cæcutiunt illi summo meridie, qui videre ipsas non vident neque intelligunt* : Which he might have said with far better Reason, if his Eyes had been but assisted with one of our common Microscopes.

To this Purpose also belongs the surprisingly beautiful and curious Mechanism observable in the immoveable Eyes of Flies, Wasps, &c. they nearly resemble two protuberant Hemispheres, each consisting of a prodigious Number of other little Segments of a Sphere ; all which Segments are perforated by a Hole which may be called their *Pupil*, in which this is remarkable, that every *Foramen* or Pupil is of a lenticular Nature, so that we see Objects through them topsy turvy, as through so many convex Glasses ; yea they become a small Telescope, when there is a due focal Distance between them and the *Lens* of the Microscope.

scope. *Leuwenhoek's* Observations make it probable that every *Lens* of the *Cornea* supplies the Place of the *crystalline* Humour, which seems to be wanting in those Creatures, and that each has a distinct Branch of the optick Nerve answering to it, upon which the Images are painted; so that as most Animals are binocular, and Spiders for the most part octonocular, so Flies, &c. are multocular, having, in effect, as many Eyes as there are Perforations in the *Cornea*. By which means, as other Creatures but with two Eyes are obliged, by the Contraction of the Muscles above described, to turn their Eyes to Objects, these have some or other of their Pupils always ready placed towards Objects nearly all round them; whence they are so far from being denied any Benefit of this noble and most necessary Sense of Sight, that they have probably more of it than other Creatures, answering to their Necessities and Way of living: And thus provident Nature has with great Industry and Art provided for the Immobility of the Head and Eyes.

II. As in Man and most other Creatures the Eyes are situated in the Head, because, amongst other Reasons, it is the most convenient Place for their Defence and Security, being composed of hard Bones, where-
in

in are formed two large strong Sinuses or Sockets, commonly called *Orbits*, for the convenient lodging of these tender Organs; and securing them against external Injuries; so in those Creatures, whose Head, like their Eyes and the rest of their Body, is soft and without Bones, Nature hath provided for this necessary and tender Organ, a wonderful kind of Guard, by enduing the Creature with a Faculty of withdrawing its Eyes into its Head, and lodging them in the same Safety with its Body. We have a very beautiful Example of this in Snails, whose Eyes are lodged in their four Horns, like atramentous Spots, one at the End of each Horn, which they can retract at pleasure when in any Danger. I know the learned *Perrault* (in his *mechanique des animaux*) seems to doubt of Snails having Eyes: And *Dr. Brown* ranks this Conceit of the Eyes of Snails amongst the Vulgar Errors of the Multitude; but a good Microscope would soon have shewn him his own Error. Those that desire further Satisfaction in this Particular, may consult *Dr. Power's* Observations, and *Lister de Cochleis & Limacibus*.

If it should be here asked, Whence it is that Fishes, whose Eyes are not guarded and defended by Eye-lids, should not also have

a Power of retracting their Eyes for their Defence and Security? To this I answer, That if we reflect on the Hardness of the *Cornea*, which, in all Animals that want Eye-lids, exactly resembles the Horn of a Lanthorn, and therefore is not to be hurt by such Particles as their Eyes are commonly exposed to, we must see that such a Mechanism would have been useless: And besides; in some crustaceous Animals, whose Occasions and manner of living perhaps exposes their Eyes to greater Dangers and Inconveniencies, their Eyes are well secured by deep Sinuses, into which, as into a safe Chamber, they can retract their Eyes upon the Approach of any Danger, as has been well observed by *Fabricius ab Aquapendente* (in his *Treatise de oculo, cap. 14.*)

Something of a Mechanism similar to this has also been thought to obtain in the Eyes of Moles, which are not blind, as *Aristotle, Pliny, Severinus, &c.* would persuade us; but being provided with little black Eyes about the Bigness of a small Pin-head, in which not only the *aqueous, vitreous* and *crystalline* Humours, but also the *Ligamentum ciliare*, copped or conical *Cornea*, with the round Pupil and optick Nerve, have been manifestly discerned, they must necessarily serve to guide and se-

cure

cure it, when it chances to be above Ground. But because this Animal lives most under Ground, which it digs and penetrates, it was necessary their Eyes should be well guarded and defended against the many Dangers and Inconveniencies to which their manner of living exposes them; and this is the Reason why their Eyes are so small, and that they are situated so far in the Head, and covered so strongly with Hair, that they can be of no Service to them, unless they be possessed of a Power of protruding and retracting them at Pleasure, more or less as they have more or less Occasion to use or guard their Eyes, as has been observed by *Borrichius, Epist. Bartholin. 92. cent. iv.* Mr. *Derham's Physico-Theology, Book iv. Chap. 2. &c.*

III. The *third* and *last* Reflection we shall make upon the Motion of our Eyes, is, what regards a Problem which has very much perplexed both Physicians and Philosophers, *viz.* What is the Cause of the uniform Motion of both Eyes?

In some Creatures, such as Fishes, Birds; and among Quadrupeds, the Hare, Camelion, &c. the Eyes are moved differently, the one towards one Object, and the other towards another: But in Man, Sheep, Oxen and Dogs, the Motions are so uniform that

they never fail to turn both towards the same Place. Hence in Operations upon the Eye, that require it to be kept immoveable for some Time, it is necessary to tie up the sound Eye with Compress and Bandage, by which means the other is easier kept fixed and immoveable.

The final Cause of this uniform Motion of our Eyes is,

1. That the Sight may be thence rendered more strong and perfect; for since each Eye apart impresses the Mind with an Idea of the same Object, the Impression must be more strong and lively when both Eyes concur, than when only one; and consequently the Mind must receive a more strong, lively and perfect Idea of the Object in View, as is agreeable to Experience: And that both may concur, it is necessary they move uniformly; for though the *Retina* or immediate Organ of Vision, be expanded upon the whole Bottom of the Eye as far as the *Ligamentum ciliare*, yet nothing is distinctly and clearly seen but what the Eye is directed to. Thus in viewing any Word, such as MEDICINE, if the Eye be directed to the first Letter M, and keep itself fixed thereon for observing it accurately, the other Letters will not then appear clear or distinct, because the several Pencils

Pencils of Rays that come therefrom, fall too obliquely on the *Crystalline* and other Humours of the Eye, to be accurately collected in so many distinct Points of the *Retina*; and chiefly because of a certain Degree of Hardness, Callosity or Insensibility that obtains in all Parts of the *Retina*, excepting towards the *Axis* of the Eye, directly opposite to the Pupil. Hence it is that to view any Object, and thence to receive the strongest and most lively Impressions, it is always necessary we turn our Eyes directly towards it, that its Picture may fall precisely upon this most delicate and sensible Part of the Organ, which is naturally in the *Axis* of the Eye. But if this most sensible and delicate Part happen, from a Fault in the first Conformation, or from any other Cause, not to be in the optick *Axis*, but a little off at a Side; then to see an Object clearly, the Eye must not be directed towards it, but a little to a Side, that its Picture may fall on this most sensible Part of the Organ: And this may be one Cause of Squinting, which, as is easy to see, must be altogether incurable.

Now though it is certain that only a very small Part of any Object can at once be clearly and distinctly seen, namely, that

whose Image on the *Retina* is in the *Axis* of the Eye; and that the other Parts of the Object, which have their Images painted at some Distance from this same *Axis*, are but faintly and obscurely perceived, yet we are seldom sensible of this Defect; and, in viewing any large Body, we are ready to imagine that we see at the same Time all its Parts equally distinct and clear: But this is a vulgar Error, and we are led into it from the quick and almost continual Motion of the Eye, whereby it is successively directed towards all the Parts of the Object in an Instant of Time; for it is certain that the Ideas of Objects, which we receive by Sight, do not presently perish, but are of a lasting Nature, as appears from what happens when a Coal of Fire is nimbly moved about in the Circumference of a Circle, which makes the whole Circumference appear like a Circle of Fire, because the Idea of the Coal, excited in the Mind by the Rays of Light, are of a lasting Nature and continue, till the Coal of Fire in going round return to its former Place; and therefore if our Eye takes no longer Time to direct itself successively to all the small Parts of an Object, than what the Coal of Fire takes to go round, the Mind will distinctly perceive all those Parts, without
being

being sensible of any Defect or Insensibility in any Part of the *Retina*, because the Idea of one Part continues, till, by the Motion of the Eye, the Image of the other Parts be successively received upon the same most sensible Part of the *Retina*: And this is the Reason why the Globe of the Eye moves so quickly, and that its Muscles have such a Quantity of Nerves to perform their Motions. But I go on.

2. A *second* Advantage we reap from the uniform Motion of our Eyes, which is yet more considerable than the former, consists in our being thereby enabled to judge with more Certainty of the Distance of Objects.

There are six Means which concur for our judging of the Distance of Objects, of all which the most universal and, frequently, the most sure, is the Angle which the Rays of Light make at the Object in coming thence to our Eyes: When this Angle is very great, we see the Object very near; and, on the contrary, when it is very small, we see it at a great Distance; and the Change which happens in the Situation of our Eyes, according to the Change of this Angle, is a Mean which our Mind makes use of for judging of the Distance and Proximity of Objects. To be perswaded of

the Truth of this, suspend by a Thread a Ring, so as its Side may be towards you. and its Hole look right and left, and taking a small Rod, crooked at the End, in your Hand; retire from the Ring two or three Paces, and having with one Hand covered one of your Eyes, endeavour with the other to pass the crooked End of your Rod through the Ring. This appears very easy, and yet, upon Trial, perhaps once in a hundred times you shall not succeed, especially if you move the Rod a little quickly. This surprising Difficulty, which is found in passing the Rod, arises, because when one Eye is shut, the Angle which the Rays of Light make at the Object, in coming thence to both Eyes, is not known; for in any Triangle to know the Bigness of an Angle, it is not sufficient to know the Length of the Base subtending that Angle, and the Magnitude of the Angle which one of its Sides makes with that Base, as is known to Mathematicians, but it is also necessary to know the other Angle which the other Side makes with the Base: But this can never be known but in opening both Eyes, and directing them to the Object; and therefore the Mind can never make use of its natural Geometry, for judging of the Distance of the Ring, when one of the Eyes is shut.

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From this we may see the Use of having two Eyes placed at a certain Distance from one another; for by Use we get a Habit of judging of the Distance of Objects by the Direction of the *Axes*, which is sensible to us, because it depends on the Motion of the Eye that we feel. But other Creatures that look differently with their Eyes, as Fishes, Fowls, the Hare, Camelion, &c. cannot judge of the Distance of Objects from this Angle, and therefore must be more liable to Mistakes than we are; yet Nature has provided them with two Eyes, that their Sight might not be too much limited, but that they might see Objects equally well on both Sides, and thereby be better enabled to seek their Food, and avoid Dangers: Whence it is, that in some Animals they are seated so as to see behind them, as well as on each Side. We have a very remarkable Example of this in Hares and Conies, whose Eyes are very protuberant, and placed so much towards the Sides of their Head, that their two Eyes take in nearly a whole Sphere; whereas in Dogs that pursue them, the Eyes are set more foreward in the Head to look that Way more than backward.

From this also we may see, why we err so frequently in the Judgments we form of
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The Magnitude of Objects seen only with one Eye: For since we judge not of Extension or Magnitude from the apparent Magnitude alone, but also from the apparent Distance; it follows, that Objects seen with one Eye, must appear smaller or greater, as they are imagined nearer or further off. Thus a Planet viewed with a Telescope, sometimes is judged near the Eye-Glass, and therefore appears very small, while to others it appears very great, because imagined a good Way beyond the Objective. The same Thing happens in viewing one's self in a great concave Mirror not too far off; when the one Eye is shut, the Face does not appear very big, because it is imagined at no greater Distance than the Surface of the Mirror; but to both Eyes it appears a great deal bigger, because it is then imagined much further off, as has been observed by Mr. *Mariotte* (*Traité des couleurs.*)

It being therefore manifest, That the Disposition of our Eyes, which always accompanies the Angle formed of the visual Rays that flow to both Pupils, and that cut one another in that Point of the Object on which our Eyes are fixed, is one of the best and most universal Means we have for judging of the Distance of Objects;
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it needs be no Surprise, that in very great Distances, where the Distance of our Eyes bears no sensible Proportion to the Distance of the Object, it should be impossible for us, by this or any other Method, to judge rightly of the Distance, because the Change that happens here to this Angle is so small, as to be altogether insensible.

Every Body must see that this Angle changes considerably, when an Object that is only a Foot from our Eyes is transported to four; but if from four it be transported to eight, the Change is by much less sensible; if from eight to twelve, it is yet less; if from a thousand to a hundred thousand, it is scarce any more sensible, nay not tho' the Distance be increased from a thousand to an infinite Space.

It is for this Reason that we are so often deceived in the Judgment we form of all great Distances, and that we see the Sun, Moon and Stars, as if they were involved in the Clouds, though it is certain they are vastly beyond them. And being deceived as to their Distance, we must also be deceived with respect to their Magnitude. Thus the Moon seems greater than the greatest Star, though every Body knows that she is vastly less. Thus the Sun and Moon appear not above a Foot or two in
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Diameter, if we trust the Testimony of our Eyes, as did *Epicurus* and *Lucretius*, who therefore imagined them no bigger than what they appeared. Thus also the Sun and Moon appear greater when near the Horizon, than at a greater Height, because when nigh the Horizon, they are judged at a greater Distance.

There is yet another Advantage full as considerable as any of the former, that is thought to arise from the uniform Motion of our Eyes, and that is, the single Appearance of Objects seen with both Eyes.

This indeed at first View does appear very probable; for if, in looking to any Object, you press one of your Eyes aside with your Finger, and alter its Direction, every Thing will be seen double, which is a common Experiment wherewith Children amuse themselves, being delighted with the uncommon double Appearance of Objects.

The same thing also happens, when either of the Eyes is, from a Spasm or Paralysis of any of its Muscles, or from any other Cause, restrained from following the Motions of the other. Thus *Willis* (in his *Anima Brutorum, cap. 15.*) tells us of a young Man, long ill of the Palsy, who at last came to see all things double, from a Spasm in the *adducent* Muscle of his left
Eye,

Eye, whereby its *Axis* was turned inwards, so that it could not be directed to the same Object with the other.

Platerus likewise (in the first Book of his *Observations*, p. 132.) gives us the History of a Boy, who after having received a Stroke on his Head, became paralytick in one of his Sides, and had his Mouth distorted; to whom every Thing he looked at appeared double: And tho' he does not attempt to account for this Depravation of Sight, yet it is easy to see that it could proceed from nothing but a Palsy or Spasm of one of the Muscles of one of his Eyes, by which it was rendred incapable of following the Motion of the other.

Langius also has a very remarkable Case to this purpose, which being a little uncommon, we must not omit. He tells us (in the 7th Epistle of his first Book) That in a Wound of the Eye, it happened, through Neglect, to unite and adhere to the under Eye-lid; so that, after the Cure, that Eye was tied down, and rendred incapable of following the Motions of the other: This occasioned every thing to appear double, till the Eye by its frequent Motions had at last stretched the Eye-lid, to which it was adherent, and thereby recovered its former Liberty of moving uniformly with the other.

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Multitudes of Cases of this Kind might be advanced, but I like not, without Necessity, to multiply Examples of the same Nature; these are sufficient to prove, that when our Eyes are restrained from moving uniformly, all Objects are seen double. Neither is it to be doubted, but when the same *Phænomenon* occurs in drunk or maniac Persons, it proceeds from the like Cause: The uniform Motion of our Eyes requiring an easy and regular Motion of the Spirits, which frequently is wanting in such Cases.

The same Thing does also happen sometimes soon before Death, when the Spirits have been worn out and exhausted by long Sickness. We have a remarkable Example of this in the *Acta Hafniensia*, published by *Bartholin. Olaus Borrichius* there tells us, (*Vol. 2. p. 198*) of a Woman that had been long ill of a Disease in her Breast and Spleen, to whom, two Days before her Death, all Things appeared double. He indeed attributes this *Phænomenon* to a Change in the Figure of the Humours of the Eye, and thinks that they had acquired the Form of a Polygon, or multiplying Glass; which is a very strange out of the way Notion, and altogether improbable. The true Cause thereof seems to have arisen from the languid irregular Motion of the animal Spirits

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disqualifying them from executing the Commands of the Will, and directing both Eyes to the same Object.

For these and such like Reasons it is, that very many, both Physicians and Philosophers, have been brought to believe, that to see Objects single, it is absolutely necessary that both Eyes be directed to the same Object, and that this is one of the final Causes of their uniform Motion; and yet when the Matter shall be duly examined, I am confident, little Foundation will be found for any such Consequence. But I must delay entering upon this Subject, till I have assigned what to me appears to be the true Reason of this *Phænomenon*; because a Principle or two will be there established, necessary to be carried along in our Thoughts throughout the whole of this Argument.

Why Objects seen with both Eyes do not appear double, is a Problem that has employed the Genius and Invention of the greatest Men of all Ages. *Gassendus* and *Porta* found such Difficulty in reconciling this Appearance with the ordinary Principles of Philosophy and Opticks, that they have been forced to suppose, that tho' both Eyes are open, yet we only see with one at a Time. But this being so obviously contrary to common Experience, serves
more

more as an Example to shew what surprising Lengths Fancy may carry even the greatest Men, than to satisfy the curious!

Galen imagined that this single Appearance of Objects proceeds from the close Coalition of the Optick Nerves behind the *Os Sphenoides*, and seems to triumph in the Discovery, as if he had found out a fine Reason why our Optick Nerves are thus united, (*lib. 10. de offic. part. cap. 14.*) In this he is followed by a great many Philosophers as well as Physicians, tho' they are much divided among themselves in their manner of explaining it. *Galen* himself had Recourse to a Communication of Pores, and followed the Doctrine of *Herophilus* in giving to each Nerve one Pore; which he made to communicate at the Conjunction of the Nerves. But as this Communication of Pores is by our best Anatomists now look'd on as mere Hypothesis, that has no Foundation in Nature, so it is altogether insufficient for solving the Problem, tho' in place of one Pore, each Nerve should, agreeable to the more modern Notion, be allowed to have as many of them as there are nervous Fibres, as some of the Followers of *Galen* have indeed supposed.

Our justly eminent Sir *Isaac Newton* (in the Queries annexed to his Opticks) accounts
for

for it thus, “ Are not the Species of Objects
 “ seen with both Eyes united, where the
 “ Optick Nerves meet before they come in-
 “ to the Brain, the Fibres on the right Side
 “ of both Nerves uniting there, and, after
 “ Union, going thence into the Brain, in
 “ the Nerve, which is on the right Side
 “ of the Head; and the Fibres on the left
 “ Side of both Nerves uniting in the same
 “ Place, and, after Union, going into the
 “ Brain, in the Nerve which is on the left
 “ Side of the Head; and these two Nerves
 “ meeting in the Brain, in such a manner
 “ that their Fibres make but one entire
 “ Species or Picture, half of which, on the
 “ right Side of the *Sensorium*, comes from
 “ the right Side of both Eyes, through the
 “ right Side of both Optick Nerves, to the
 “ Place where the Nerves meet, and from
 “ thence on the right Side of the Head, in-
 “ to the Brain; and the other half, on the
 “ left Side of the *Sensorium*, comes in
 “ like manner from the left Side of both
 “ Eyes.”

This is indeed the most beautiful and in-
 genious Explication of the Manner how an
 Object appears single from the Coalition of
 the Optick Nerves that ever appeared;
 and to render it still more probable, the
 same great Man observes, “ That the Optick

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“ Nerves

“ Nerves of such Animals, as look the same
 “ Way with both Eyes (as of Men, Sheep,
 “ Dogs, Oxen, &c.) meet before they
 “ come into the Brain; but the Optick
 “ Nerves of such Animals as do not look
 “ the same Way with both Eyes (as of
 “ Fishes and of the *Chameleon*) do not
 “ meet.” These Reasons do indeed render
 his Hypothesis very probable, yet there
 are others so demonstrative of the contra-
 ry, that it is not to be doubted, but had
 they been known to *Newton*, he had re-
 tracted his Opinion, especially since the
 Thing admits of an easy Solution, without
 any such Supposition: For,

Although the Optick Nerves are united
 at the *Sella Turcica*, yet this happens
 without any Confusion or Decussation of
 their Fibres. It is indeed true, that their
 Conjunction is so close, that their Substan-
 ces seem to be confounded, yet there are
 several Observations which prove that they
 are united only by a close Conjunction,
 without any Decussation, Intersection, Mix-
 ture or Confusion of Substance, of which
 I shall only mention two; the one is from
 the accurate and faithful Anatomist *Vesalius*.
 His Words are, *Porro iis qui de con-*
gressu hoc meatuque acriter citra partium
inspectionem indies altercantur, non gra-
vabor

vabor duo, quæ in congressu animadverti, hic adjicere, quo & hinc suarum nugarum habeant argumenta. Patavii itaque adolescens suspendio necatus publicæ sectioni adhibitus fuit, cui ante annum dexter oculus à carnifice erutus fuerat: deinde mulier, eodem supplicio affecta, nobis ob-
tigit, cui dexter quoque oculus ab ineunte ætate emarcuerat, sinistro interim integerrimo. Mulieri dexter nervus toto progressu longe tenuior sinistro visebatur, non solum extra calvariae cavitatem, verum in exortu quoque, & in dextra congressus nervorum sede. Ac præterquam quod dexter tenuis erat, durior quoque & rubicundior cernebatur, uti sanè & in adolescente: sed dexter non admodum, neque crassitie, neque mollitie adhuc sinistro cedebat. (De corp. hum. fabrica, lib. iv. c. 4.) The other Observation which I shall take notice of, is from Cæsalpinus, whose Words, as recorded by Riolan, (Anthropograph. lib. iv. cap. 2.) and Diemerbroek (Anatom. corp. human. lib. iii. cap. 8.) are as follows, Repertus est aliquando in anātome alter ex nervis visoriis attenuatus, alter plenus: visus autem erat imbecillis in oculo ad quem nervus extenuatus ferebatur; habuit enim vulnus in capite circa eandem partem: nervus autem extenuatus non ad

oppositam partem procedebat, sed ad eandem flectebatur. Visum hoc est Pisis anno 1590. Unde omnes spectatores argumentum id certum existimaverunt, nervos visorios nequaquam se interfecare, sed coire & regredi ad eandem partem.

From these and such like Observations, it plainly follows, That our Optick Nerves do not intersect each other, nor mix and confound their Substances, but are only united by a close Cohesion, contrary to what the Opinion of *Newton* and the *Galienists* supposes.

But this is not all ; for supposing our Optick Nerves to be united in what manner they please ; yet that the single Appearance of Objects seen with both Eyes, does not depend on this Union, seems evident from another Observation of the same *Vesalius*, which being a little uncommon, I shall also set down at length in the Author's own Words. *His ille accessit* (says he, speaking of the former Observations) *cujus nervos visorios illo de quo hic sermo est congressu invicem non connasci neque sese contingere vidimus : sed dexter nonnihil eâ sede, qua calvariam egressurus fuerat, sinistrorsum, & sinister nonnihil dextrorsum flectebatur, quasi non coalitûs occasione nervi congréderentur, verum ut commodè per suum*

*suum foramen è calvaria prociderent : potissimum quum etiam hoc ductu progredientes, in oculi posterioris sedis medium non inserantur. Quàm sedulò autem ac sollicitè ejus viri, cui in eum modum nervi dehiscebant, familiares, num illi omnia gemina perpetuo oculis obversarentur, interrogaverimus, neminem naturæ operum cognitione flagrantem ambigere sat scio; at nihil aliud resciscere licuit, quam ipsum de visu nunquam conquestum fuisse, visuque præstante semper valuisse, familiaresque de visorum duplicatione nihil unquam intellexisse. Seeing then that Objects have appeared single to such as had their Optick Nerves disjoined, it must be allowed that this *Phænomenon* depends on something else than the Coalescence or Decussation of these Nerves. Others therefore laying aside all the Hypotheses that are founded upon any Coalescence, Contact, or Crossing of the Optick Nerves, have sought for the Cause of this *Phænomenon* in a certain Sympathy betwixt them. To explain this Sympathy, Mr. Robault (*Physic. part. 1. cap. 31.*) supposes, that in each Nerve there are just as many Fibres as in the other, and that the corresponding Fibres of both Nerves are united in the same Point in the *Sensorium*. e. g. Suppose, as in *Tab. I. Fig. 1.**

the Nerves composed of five Fibres, whose Extremities in the right Eye are A, B, C, D, E, and in the other Eye, *a, b, c, d, e*. The corresponding Fibres, *Aa, Bb, Cc, Dd, and Ee*, are suppoed to meet in the *Sensorium* S, in the Points $\alpha, \beta, \gamma, \delta, \epsilon$. Hence if both Eyes are directed to F, its Image will fall on the *Retina* at the Optick Axes, and there strike the sympathizing Fibres C and *c*; which Motion being propagated to the single Point of the *Sensorium* γ , must there make but one Species or Picture. In like manner the Eyes retaining the same Direction, the Image of the Point G will fall upon the right Side of both Eyes; and by striking the correspondent Fibres E and *e*, will, in the *Sensorium*, make but one Impression at ϵ , where these Fibres terminate; and the Image of the Point H, by striking the corresponding Fibres A and *a*, will, in the *Sensorium*, make but one Impression at α : And thus, though both Eyes receive the same Impressions from Objects, yet they are not seen double, becaufe of these two Impressions or Images, one is only formed in the *Sensorium*.

But neither has this Hypothesis, however specious, any Foundation in Nature; for if, with *des Cartes*, we suppose the *Glandula pinealis* to be the *Sensorium*, or chief Seat
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of the Soul, Anatomy teaches us, that the Nerves are not inserted into it; and if, with *Willis*, we should place the *Sensorium* in the *Corpora striata*, or any other Part of the Brain, these being double and alike in both Sides, can never make one individual *Sensorium*, in which all the corresponding analogous nervous Fibres are united.

The judicious Dr. *Briggs* (as may be seen at large in the *Philosophical Transactions*, and in his *Nova visionis Theoria*, annexed to his *Ophthalmographia*) has invented another Hypothesis for explaining this supposed Sympathy of our Eyes, without having Recourse to any Meeting, Communication or Conjunction of the nervous Fibres in the *Sensorium*. He supposes that the Optick Nerves consist of homologous Fibres, which have their Rise in the *Thalami nervorum opticorum*, and are thence continued to both *Retinæ*, and that these Fibres have the same Situation, Disposition and Tension in both Eyes; *e. g.* He supposes that the Fibres going to the upper Part of the *Retinæ*, have a greater Degree of Tension; those going to the under Part, a smaller Degree of Tension; and those going to the corresponding Sides, corresponding Degrees of Tension; and so forth; and consequently, says he, when an I-

mage is painted on the corresponding Parts of each *Retina*, the same Effects are produced, the same Notice or Information is carried to the *Thalamus*, and so imparted to the Soul, or judging Faculty ; for the homologous and corresponding Fibres of both *Retinæ*, upon which the Image falls, having the same Degree of Tension, may be conceived as Cords of two musical Instruments in Concord and Unison, which, from the Impressions of Light, are put into the same Vibrations ; so that the Mind can have but one Sensation from the same Object, since the two Impressions are reunited in one, by the similar and like Disposition of the Fibres of the two Nerves, which do so correspond with each other, and which have such a Conformity and Similitude in their Vibrations, that the Soul cannot hinder itself from identifying the two Impressions which it receives therefrom.

This is the Substance of Dr. *Briggs's* Hypothesis ; to confirm which he flies to Experience and Observation, pretending that this Variety of Tension in our nervous Fibres, is owing to their greater or lesser Flexure in the *Thalami*, which, he says, is manifest to the naked Eye ; and finding that the Fibres on the Inside of both *Thalami* agree in Flexure, as also those

those on the outside, &c. he concludes that they agree also in Tension, and consequently sympathize by a Similitude in their Vibrations. But, unluckily for the Author, this curious Observation of his, is so far from confirming his Hypothesis, that it quite undermines it; for all Objects a little to a Side of the Concourse of the optick *Axes*, would then appear double, by being painted on dissimilar Parts of the *Retina*; whereas had he laid aside his Observation, and with *Newton*, *Robault*, &c. contented himself in supposing, that the Fibres on the Inside of one Eye sympathize with the external Fibres of the other, his Hypothesis had not been chargeable with this Absurdity, though even then many Reasons are not wanting for rejecting it; as,

I. It is a very difficult Matter to conceive how the soft, tender and delicate Fibres of the *Retina* and medullary Part of the optick Nerves, can, without breaking, suffer that strong Tension which seems necessary to qualify them for being put into those vibrating Motions, in which he makes Vision to consist. And it is more probable, that the Impressions made upon our Organs produce an Undulation and Refluctuation of the Spirits, or of *Newton's materia subtilis* in the nervous Fibrils; which reaching the

the *Sensorium*, gives us the Ideas of Objects, than that these Ideas should be excited by these Vibrations themselves. This I might easily evince from a great many Arguments which I must not now mention, because they would carry us too far out of our Road; and especially because though we allow all Sensation to proceed from the Vibrations of our nervous Fibres, yet this does not appear sufficient to establish his Hypothesis: For,

2. Supposing all Sensation to proceed from Vibrations excited in the nervous Fibres, and that these Fibres in the analogous and corresponding Parts of the *Retinae*, have the same Degree of Tension; *ex. gr.* Suppose the Tension of the superior Fibres of both *Retinae* to be the same, as also that of the inferior; but that the Fibres which terminate in the superior Part are more tense than those that go to its inferior Part: This is what our Author supposes. Now, according to this Hypothesis, it would follow, that Vision would be more clear and strong when caused by Rays striking the upper Part of the *Retina*, than when caused by Rays striking its inferior Part, where the Fibres being less stretched, must make the Vibrations more languid and faint; and consequently an Object placed be-

low

low the optick *Axis*, by painting its Image upon the superior Part of the *Retina*, would appear more clear and lively than when it is placed above it: But this is contrary to all our Experience; and what we have said of the superior and inferior Fibres, holds equally in all the rest: For Vision being every where uniform, it is necessary that the Fibres, by whose Vibrations it is supposed to be occasioned, should be every where equally stretched.

3. If the Concord, Harmony and equal Tension of the analogous and corresponding nervous Fibres, were the Reason why Objects seen with both Eyes appear not double, it is not easy to conjecture why this Depravation of Sight does not happen oftner than it is found to do in Practice, and especially in such as abound with serous and phlegmatick Humours, and whose Brain is moist and lax, and who thereby are disposed to the *Gutta serena*, or subject to Convulsions and other nervous Diseases; for, in such, the Fibres of one of the optick Nerves may easily happen to be relaxed, while the corresponding Fibres of the other Nerve still retain their natural Tension; and in particular, why did not that Woman, formerly mentioned from *Cæsalpinus*, see Objects double, since one of the optick Nerves

Nerves was found withered and emaciated, while the other remained moist, plump and juicy as before? Surely one would expect that this could not have happened in the Nerves, without affecting the Tension of their Fibres, and thereby have occasioned Objects to appear double, yet no such thing happened; for every thing appeared single as before, only the Sight of the diseased Eye was more faint and obscure than in the other: From which it follows, that the Cause of this *Phænomenon* is to be sought for some where else, than in the similar Situation, Disposition and Tension of the nervous *Fibrillæ*.

The true Cause why Objects appear not double, though seen with both Eyes, to me seems wholly to depend on the Faculty we have of seeing Things in the Place where they are. But to explain and confirm this, I must premise the following

L E M M A.

Every Point of an Object appears and is seen without the Eye nearly in a straight Line, drawn perpendicularly to the Retina, from that Point of it where its Image falls.

That this is true, we may gather from many Experiments. The following is very easy and convincing.

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Suppose E the Globe of the Eye, furnished with all its Coats and Humours, (see *Fig. 2.* and *3.*) and let A be a small Object, such as the Head of a Pin, whose Distance from the Eye must be greater or less than that at which an Object would be most distinctly seen when viewed with the naked Eye. Close to the Eye place a Card or Piece of opaque Paper, in which is a small Hole made with a Pin, and let QT represent the Card. If this Hole be supposed at x , then the Ray of Light Axn , falling on the *Retina* at n , will there paint the Image of the small Object A, and make it appear in the visual Line nxA , which is perpendicular to the *Retina* at the Point n . But if the Card be brought lower, so as its small Hole may be at r , the Ray of Light Ar , after passing the Hole, will be refracted in the Eye, so as to fall upon the *Retina* at some other Point as m : For the Object A being supposed at a greater or lesser Distance than that at which an Object may be most distinctly seen with the naked Eye, all its Rays that pass the Pupil must be made to converge to a Point, either before or behind the *Retina*, such as o ; but on the *Retina* itself they must fall on different Points, according to the Situation of the Hole through which they pass; for the Eye does
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not change its Conformation, and adapt itself to the Distance of an Object viewed through a perforated Card, as it always does when Objects are viewed naked without any such Interposition. Now the Object *A* seen through the Hole *r*, does not appear in its real Place *A*, but at some other Place, as *B*, *viz.* in the right Line *mB*, which is perpendicular to the *Retina* at the Point *m*; and if the Card be raised, so as the Ray *Ad* may pass the Hole at *d*; after Refraction, it will fall upon the *Retina* at *i*, and the Object will appear nearly at *C* in the Perpendicular *iC*.

In like manner, if the Card be pierced with three small Holes, whose Distance does not exceed the Diameter of the Pupil, as in *d*, *x* and *r*, then the little Object *A* will at the same Time be seen in three different Places, *C*, *A* and *B*, and must therefore appear multiplied, according to the Number of Holes; which evidently proves, that the Rays that flow from the Object through these Holes, fall upon different Points of the *Retina*; and that there are three Lines drawn perpendicularly from these Points in the *Retina*, in each of which the Object is distinctly seen. We might here observe, that if the Object *A* be brought to that precise Distance from the Eye that is necessary

ry for uniting all its Rays in one single Point of the *Retina*, as n , then it will appear single, though viewed through several Holes: And the same thing must happen, though the middle Hole be covered, so as no Rays fall upon the Eye but what pass at the Holes d and r , towards the Extremities of the Pupil; for these Rays being united in the *Retina* at n , the Object will be seen in the visual Line nxA , though no Rays pass that Way. From all which it is evident, that every little Object or Point of an Object, appears and is seen in the visual Line, drawn perpendicularly to the *Retina*, at that Point of it where its Image falls.

To make this Experiment with Exactness, you must, for an Object, look to a small luminous Point in a dark Place, such as a little Hole in a Card placed before a Candle, or else you must look to a small black Object placed on a white or luminous Surface, as has been observed by *Scheneir* (*Fundament. Optic.*) who has several other curious enough Observations relative to this Experiment. Any Trials I had occasion to make succeeded well enough with a Pin placed before a well-lighted Window.

It is from this Principle, that when a Man in the Dark rubs the under Part, or either Corner of his Eye with his Finger, and
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turns his Eye away from his Finger, he will see, towards the opposite Side of the Eye, a Circle of fiery Colours like those in the Feather of a Peacock's Tail, which can arise from nothing but such Motions excited in the *Retina* by the Pressure and Motion of the Finger, as at other Times are excited there, by Light coming from the opposite Side for causing Vision. Whence this Experiment may be of Use in distinguishing a Cataract that admits of the Operation from one that is complicated with an *Amaurosis* or *Paralysis* and Insensibility of the Nerve: For if in rubbing the Eye in the Manner just now mentioned, no coloured Circle appears, it is a Sign that the Nerve is paralytick, and that nothing is to be expected from the Depression of the Cataract: Whereas, on the contrary, the Appearance of such a Circle plainly shews that the Nerve is not affected, and consequently that the Success of the Operation is not to be wholly dispaired of, even though the *Pupil* should be without Motion: For such an Immobility of the Pupil does not always proceed from an Insensibility of the Nerve, but is also sometimes occasioned either by the Pressure of the Cataract against the *Uvea*, or by their Adhesion; neither of which
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are esteemed sufficient to render the Operation always fruitless.

It is likewise from this Principle, that an Object seen through a Prism appears so far removed from its true Place, and that an Object seen through a *Polyedrum* or multiplying Glass, appears in so many Places at once, and therefore appears as often multiplied.

The same Principle is also confirmed from the erect and natural Appearance of Objects, though their Image on the *Retina* be inverted: Thus (in *Fig. 1.*) H, the lower Part of the Object GH is projected on *a*, the upper Part of the Eye, and the highest Part G is projected on the lowest Part of the Eye, which makes the Image or Representation *ae* inverted; yet because the Point G appears without the Eye in the Line *eG*, and the Point H in the Line *aH*, the Point G must of Necessity be seen higher than the Point H.

What hath occasioned some seeming Difficulty in the Business of erect Appearances, is the groundless Supposition, that the Eye, or rather the Soul, by means thereof, sees an inverted Image of the external Object painted on the *Retina*, and that it judges of the Object from what it observes in this Image: But this is a vulgar Error, and I
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appeal to any one's Experience, whether he ever sees any such thing, and every one is himself best Judge of what he sees; and as the Mind sees not any Image on the *Retina*, so it takes no Notice of the internal Posture of the *Retina*, or the other Parts of the Eye, but useth them as an Instrument only for the Exercise of the Faculty of Seeing; and therefore, when the *Retina* on its lower Part, at the Point *e*, receives an Impulse or Stroke from the Rays that come from the upper Part of the Object *G*, is it not more natural, as well as useful, that the Mind, without any Regard to the Situation of that Part of the *Retina*, should, agreeable to the Principle here laid down, be directed to consider the Stroke as coming from the upper Part of the Object *G*, rather than from its lower Part *H*, and consequently to conclude the Cause of it, or the Object itself there also? And what is said of upper and lower, holds equally in sinister, dexter, and all other Parts of the Object.

This may be illustrated, by conceiving a blind Man, who, holding in his Hands two Sticks that cross each other, doth with them touch the Extremities of an Object, placed in a perpendicular Situation: It is certain this Man will judge that to be the upper Part of the Object which he touches with
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the Stick held in the undermost Hand, and that to be the lower Part of the Object which he touches with the Stick in his uppermost Hand.

SCHOLI ON.

The Judgment we form of Objects being placed without the Eye in those perpendicular Lines, or, which is nearly the same thing, the Judgments we form of the Situation and Distance of visual Objects, depends not on Custom and Experience, but on an original connate and immutable Law, to which our Minds have been subjected from the Time they were first united to our Bodies.

That the Truth of this may appear, it may be requisite we look a little into the Nature of our Sensations, and carefully observe what is meant in common Discourse, when one says he sees an Object.

Every body knows that, properly speaking, Colours are the only proper Objects of Sight. Now Colours may be considered five Ways.

1. They may be considered as the Properties inherent in the Light itself. What these Properties are, was in the Year 1666 first discovered by the incomparable *Newton*, and afterwards published in the *Philosophical*

sophical Transactions, where he also gave a Specimen of the Experiments he made for confirming his Doctrine. After that, in the Year 1704, the same great Man proposed the same Doctrine more fully, in his beautiful Treatise of *Opticks*, and confirmed it with great Variety of convincing Experiments; where he has demonstrated, that Light is not all similar and homogenial, but compounded of heterogenial and dissimilar Rays, each of which are endowed with different Properties; some, at like Incidence, being more refrangible; and others less refrangible; and those that are most refrangible, are also most reflexible: And, according as they differ in Refrangibility or Reflexibility, they are endowed with a Power of exciting different Motions or Agitations in our *Retina*; which being propagated through the Nerves to the *Sensorium*, give us those different Ideas which we call *Colours*. So that Colours, considered as Properties of Light, are not Modes or Qualifications of Light derived from the various Terminations of Light and Shadow, or from Refractions or Reflections of natural Bodies, as was the general Opinion of former Philosophers, but original, connate and immutable Properties, which in divers Rays are divers: Some Rays, when alone,
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being of such Magnitude, Figure or Solidity, as disposes them, by striking the *Retina*, to exhibite a red Colour and no other; some an Orange and no other, and some a yellow and no other; and so of the rest of simple Colours, green, blue, Indigo, and Violet. But when they are mixed and blended promiscuously, they exhibite compound Colours of different sorts, according as the Light is composed of more or fewer of the different coloured Rays, or as they are mixed in various Proportions.

2. Colours may be considered as Qualities residing in the Body that is said to be of such or such a Colour; and in this Sense, Colours are nothing but the various Dispositions of the Surfaces of Objects, whereby they are qualified to reflect only the Rays of one sort of Colour, or at least in greater Plenty than the other Colours. This was experimented in a dark Room, by illuminating Objects successively with uncompounded Light of divers Colours; for by that Means any body may be made to appear of any Colour. They have there no appropriate Colour, but ever appear of the Colour of the Light cast upon them; but yet with this Difference, that they are most brisk and vivid in the Light of their own Day-light Colour. *Minium* appeareth

there of any Colour indifferently with which it is illustrated, but yet most luminous in red; and so Bile appeareth indifferently of any Colour with which it is illustrated, but yet most luminous in blue; and therefore *Minium* reflecteth Rays of any Colour, but most copiously those endued with red; and consequently, when illustrated with Day-light, that is, with all sorts of Rays promiscuously blended, those qualified with red shall abound most in the reflected Light, and, by their Prevalence, cause it to appear of that Colour. And for the same Reason, Bile reflecting blue most copiously, shall appear blue, by the Excess of these Rays in its reflected Light, and the like of other Bodies. And that this is the entire and adequate Cause of their Colours, is manifest; because they have no Power to change or alter the Colours of any sort of Rays incident apart, but put on all Colours indifferently with which they are enlightened. But we must remit those who desire full Satisfaction in this and the foregoing Point, to that admirable Treatise of *Opticks* written by *Newton*; for it is impossible to separate the Parts of this Work from one another, without Disadvantage to them, or to sum them up in less Room, without losing some things very useful and beautiful; that
great

great Person, having before shewn how far Numbers and Geometry would go in natural Philosophy, has in his *Opticks* manifested to the World, to what surprising Height even vulgar Experiments, duly managed and carefully examined in such Hands, may advance it.

3. Colours may be conceived as the Passion of our Organ of Sight, that is, the Agitation of the Fibres of the *Retina* by the Impulse or Stroke received from the Rays of Light; which Agitation is communicated to the *Sensorium*, or that Part of our Brain in which our Mind does principally reside, else it could perceive nothing.

4. Colours may be considered as the Passion, Sensation or Perception of the Mind itself, or that which all of us perceive, when we look at any Object. It is this only that, properly speaking, deserves the Name of *Colour*; for Colours in Objects are nothing but their Disposition to reflect this or that Sort of Rays more copiously than the rest, and in the Rays of Light they are their Disposition to excite this or that Motion in the Organs of Vision, and in them they are only different Undulations in the animal Spirits, which are propagated through the nervous Fibres to the *Sensorium*. In all this there is no Perception,

no Sensation, no Colour; for to speak truly, Colours are Sensations produced in our Mind, and do not belong either to Light, Objects, our Organs, or to any other Body, but are the Modifications of the Mind itself, which always stand connected to what passes in the Organs and *Sensorium*.

5. The *fifth* Manner in which Colours may be considered, is the Judgment which our Mind naturally forms; when it concludes, that *that* which it feels or perceives is in the Body itself said to be coloured, and not in the Mind. How Body acts upon Mind, or Mind upon Body, I know not; but this I am very certain of, that nothing can act, or be acted upon where it is not; and therefore our Mind can never perceive any thing but its own proper Modifications, and the various States and Conditions of the *Sensorium* to which it is present: For when I look at the Sun or Moon, it is impossible that these Bodies so far distant from my Mind, can with any Propriety of Speech be said to act upon it. To imagine otherwise, is to imagine Things can act where they are not present; which is as absurd, as to suppose that they can be where they are not. *Nam virtus sine substantia subsistere non potest. Newton princip. mathemat. schol. general. sub fin.* These Bodies

dies do indeed emit Light, which falling upon the *Retina*, does excite certain Agitations in the *Sensorium*, and it is these Agitations alone which can any way act upon the Mind, and therein excite those Modifications which we call *Colours*; so that it is not the external Sun or Moon which is in the Heavens which our Mind perceives, but only their Image or Representation impressed upon the *Sensorium*. How the Soul of a seeing Man sees these Images, or how it receives those Ideas from such Agitations in the *Sensorium*, I know not; but I am sure it can never perceive the external Bodies themselves to which it is not present: So that, properly speaking, the Colours which our Mind perceives, when we look at any Object, are only the Modifications of the Mind itself, arising from the Motions excited in the *Sensorium*; and when we imagine we see these Colours in the external Object itself, this certainly is not a Perception, but a Judgment or Conclusion, whereby we attribute that which our Mind feels to external Objects.

What we have said with respect to *Colours*, may without Difficulty be also applied to our other Sensations: For we not only ascribe the Colours we perceive to the Objects we look at, but also we judge that
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our other Sensations are in the other Objects of Sense ; thus when I taste Sugar, I conclude it is sweet ; and when I smell Camphire, or such like odoriferous Bodies, I am naturally inclined to look on that Smell, which I perceive, as a Quality inherent in the Object ; and yet it is certain that these different Sensations are only the Modifications of the Mind itself, and do not belong to the Objects to which they are generally attributed.

It is indeed true, that our Mind does not always attribute its own proper Sensations to the external Objects that produce them ; for sometimes it ascribes them to the Organs, at other Times both to our Organs and the Object.

That we may explain how this happens, we must consider, That the Sensations of our Mind are of three different Sorts ; some are very strong and lively, others weak and faint, and a third sort are of a middle Nature betwixt both.

Our strong and lively Sensations are those that touch our Mind very sensibly, and as it were, surprize it and rouse it up with Force and Vigour ; and of this sort are all those Sensations which are very agreeable or painful, such as that which arises when one is tickled with a Feather, or
burnt

burnt with the Fire, and in general when the Organs suffer any thing that is capable of hurting or destroying the Body ; in all these Cases our Sensations are so brisk and lively, that the Mind can scarce hinder itself from looking on them, as in some sort belonging to itself; and therefore it does not judge that they are in the Objects, but believes them to be in the Members of its Body, which, because of the strict Union betwixt Mind and Body, it considers as a Part of itself. Thus, when my Hand is pricked with a Pin, burnt, or otherwise hurt, I am naturally directed to attribute that painful Sensation to that Part of my Hand on which the Impression is made, and not to the Fire, Pin, or other Object producing it, and yet it is certain, that Pain is a Sensation or Modification of the Mind itself, and belongs as little to our Organs as Colours do to Objects.

The *second* Sort of Sensations are the weak and languishing, in which the Mind is but very slightly touched, and which are neither very agreeable nor disagreeable, as Light, when not too strong ; all manner of Colours, Tastes and Smells, moderate Sounds, &c. These Sensations do so slightly affect our Mind, that it never thinks that they belong to it, nor that they are in
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the Body to which it is united, but only in the external Objects that produce them. It is for this Reason we rob the Mind of its own proper Sensations of Light and Colour, therewith to deck and imbellish the Object; and yet there is nothing more evident, than that all of them are the Modifications of the Mind itself, and noways inherent in the Objects, in which our Mind places them.

The *last* Sort of our Sensations are neither strong nor faint, but of a middle Nature betwixt both, such as Heat and Cold when moderate, great Light, violent Sounds, &c. And here it may be observed, that a weak and languishing Sensation may become both a middle or strong one; as for Instance, the Sensation of Light is weak, when the Light of a Candle or Flambeau is faint, or when it is at any considerable Distance; but this Sensation may become a middle one, if the Flambeau be brought near enough the Eye, for to dazle; and likewise it may become very strong and vivid, provided that it be brought so near as to burn. Thus the Sensation of Light may be weak, strong, or betwixt both, according to its different Degrees. Now these middle Sensations do neither touch the Mind very sensibly, nor very slightly; hence it is that it is very much embarrassed and straitned where to place its
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Sensation; for, upon the one hand, it is inclined to follow the natural Judgment of the Senses, in removing from itself, as much as possible, these Sorts of Sensations, to attribute them to the external Objects; but, upon the other hand, it cannot altogether hinder itself from looking on them as in some Sort belonging to itself, especially if they approach to those which we have called strong and brisk: And this is the Reason that the Mind judges that Cold, Heat, and the other middle Sensations are not only in the Ice, Fire, and other Objects producing them, but also in that Part of the Body itself upon which the Impressions are made.

Thus you see how the Mind never considers its Sensations as belonging to itself, but always attributes them either to the Object, our Organs, or both, according as they are of a sluggish, brisk or middle Nature; and though it is certain that they are the Modifications of the Mind itself, yet since our Senses are not given us to inform us what Things are in themselves, but only what they are relatively to our Bodies, it was very necessary that they should incline us to judge of sensible Qualities in the Manner they do: As for Instance, it is much more profitable for us to feel Pain and Heat,

as in our Body, than that we should judge them only in the Objects that caused them; for, since they are capable of hurting our Members, it was necessary that we should be advertised when they are thereby attacked, in order to secure our selves therefrom: But it is not so with respect to Colours; for they do not ordinarily hurt the *Retina* on which they fall: And it is altogether useless for us to know that they are painted there. Colours are not necessary, unless to know Objects more distinctly, and at a Distance; and it is for this Reason that our Sight ever inclines us to attribute them to Objects. From all which it is manifest, That the Judgments which our Senses induce us to make concerning the sensible Qualities, are exceeding just, if considered with respect to the Preservation of our Bodies, for which they were only given us; though at the same Time it is most certain, that they are altogether extravagant, and vastly removed from Truth.

From what has been said concerning the Nature of our Sensations, it is evident that the Mind never considers any of them as belonging to itself, but as belonging to something external. Now, since there is no essential or necessary Connection betwixt these Perceptions and the Judgments

we form concerning them, it follows that these Judgments must either depend upon Custom and Experience, or on an original, connate and immutable Law.

That all of them should depend on Custom and Experience, is a Contradiction in Terms, it being impossible for us to have any Experience, till some how or other we have formed a Judgment; which Judgment must therefore depend on an original, connate and immutable Law, that cannot but obtain at least in some of our Sensations. To say otherwise, is to say something very absurd: It is to say we judge by Experience that has never been experienced. Hence it is plain, that when one says the Mind by Custom and Experience comes to conclude what it sees to be without the Eye in such perpendicular Lines; this Experience cannot be meant of Sight, but of some of our other Senses, such as that of Feeling or Touch; which therefore, by virtue of a connate and immutable Law, must naturally, and of itself, without any Assistance from the other Senses, form a Judgment concerning its own Perceptions, and conclude that they are not in the Mind, but in something external.

But if by the Touch alone we can judge thus of the Situation and Distance of external

nal Things, I see not why the same Power should be denied to the Sight. It cannot be said that it is more difficult for the Mind to trace back the Perceptions it has by Sight, from the *Sensorium* to the *Retina*, and from thence along those perpendicular Lines, to the Object itself, than it is to trace back the Perception it has by Touch from the *Sensorium* along the Nerves to the external Object occasioning them. The subjecting our Minds to a Law in seeing, is as easy as subjecting them to a Law in feeling; and that, in feeling, our Mind must be subjected to a Law, directing it to consider its own Sensations, as belonging to external Objects, has been just now shewn; and this shews the Tenor and Course of Nature, and makes it highly probable that the same Thing obtains in our other Senses; for Nature is very consonant and conformable to herself, and very simple and uniform. She never performs similar and like Effects in divers Manners, and by dissimilar and unlike Means; this were to destroy that Simplicity and Uniformity, which is the Beauty of all her Works, and which she is observed to delight so much in.

Were not the Mind, in Seeing, subjected to a Law, whereby it traces back its own Sensations from the *Sensorium* to the *Reti-*
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na, and from thence along the perpendicular Lines above-named to the Object itself; and thence concludes what it perceives to be in the external Object, and not in the Mind: It is plain that a Man born blind being made to see, would at first have no Idea of Distance or Situation by Sight. The Sun and Stars, the remotest Objects, as well as the nearer, would all seem to be in his Eye, or rather in his Mind; and if so, whence is it he comes afterwards to judge what he sees to be in the external Object? This cannot proceed from Experience alone; for though by the Touch we have frequently experienced the Existence, Distance and Situation of Things external, and found these Ideas to have been preceded by certain corresponding visible Ideas, I see not how, upon perceiving any visible Idea present with our Mind, we should judge it to be without in the external Object, without subjecting our Mind to an arbitrary irresistible Law directing it so to do. This were to establish an essential and necessary Connection betwixt these Judgments, and the Experiences we have by Touch laid up in our Memories; whereas it is plain no such Thing can be, all the Connection that is being only customary and experimental: And seeing Nature at a-

ny rate must be at the Charge of a Law, is it not more reasonable to suppose, that by the Sight alone, without any Assistance from the other Senses, the Mind, in consequence of such a connate and immutable Law, as has been allowed it in the Judgments it forms by Touch, should be enabled to trace back its own Perceptions in the so often named perpendicular Lines, to the Object itself, and thence to form a Judgment of its Distance and Situation? I say, is not this more reasonable, than to suppose that we stand in need of the Experiences of Touch? Could these Experiences be of any Use without a new Law, there might be some Pretence for such a Supposition; but this being impossible, it follows that the Judgments we form of the Situation and Distance of visual Objects, depend not on Custom and Experience, but on an original, connate and immutable Law, to which our Minds have been subjected from the Time they were first united to our Bodies. To say otherwise, is to say that our Sight is less perfect than our Touch; not from any Necessity in the Thing itself, but from an Error or Mistake in Nature. It is to make Nature do something in vain, and to be luxuriant in superfluous Causes; which is to break down the catholick and fundamental

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tal Rules of Philosophizing, established by *Newton* in his *Principia Philosophiæ*. It is to maintain, that one accustomed from the Birth to see Objects through a *Prism* or *Polyedron*, and not otherwise, would see Objects as other Men do, without any such Interposition, which to me seems very absurd and ridiculous.

From what has been said, I think the Truth of our *Scholium* is sufficiently evident; but because Dean *Berkeley* in his *Theory of Vision*, has a good deal of subtle Reasoning in favour of Custom and Experience that has not yet been taken notice of, I shall stop a little to consider it.

He observes, That in Seeing, the Mind, strictly speaking, perceives nothing but what is present with it; and thence concludes, that the Ideas of Space, Outness, Distance, and of the Situation and Magnitude of Things placed at a Distance, cannot by the Sight alone be introduced into our Minds; but that having of a long Time experienced certain Ideas perceivable by Touch, to have been connected with certain Ideas of Sight, we do, upon perceiving these Ideas of Sight, forthwith conclude what tangible Ideas are, by the wonted ordinary Course of Nature, like to follow: And thus by a habitual or customary Con-

nection that has grown up between these two Sorts of Ideas, the latter is always suggested by the former; just as Things are suggested by Words, and Shame by Blushing: So that, according to him, when a Man is said to see the Magnitude and Situation of this or that distant Object, nothing is meant, but that the Ideas of Sight which are present with the Mind, suggest to his Understanding, that after having passed a certain Distance in such a Direction, to be determined by the Motion of his Body, which is perceivable by Touch, he shall come to perceive certain tangible Ideas, which have been usually connected with them; but because there is no essential or necessary Connection between the Ideas of Sight and Touch, the Ideas, suggested by Sight, of the Distance, Situation and Magnitude of external Things, must depend entirely on Custom and Experience; for that one Idea may suggest another to the Mind, it is sufficient that they have been observed to go together, without any Demonstration of the Necessity of their Co-existence, or without so much as knowing what it is that makes them so to co-exist: Thus Words signify Things, for no other Reason, than barely because they have been observed to accompany them.

In Answer to this, I must ask Mr. *Berkeley* how it appears that the Ideas we have by Sight of the Distance, Situation and Magnitude of external Things, are nothing but the tactile Ideas suggested to our Minds. When my Eyes are shut, I can at Pleasure recal to Mind the Ideas of Touch, which former Sensations had lodged in my Memory, the bare naming the Thing doth presently suggest them as well as the seeing it: But there is no Body who doth not perceive the Difference in himself between actually looking upon an Object, and contemplating the Idea he has of it in his Memory; and therefore he hath certain Knowledge they are not both Memory or Fancy. But this is not all: For,

Though it must be acknowledged, That in seeing Objects, the Mind, strictly speaking, perceives nothing but what is present with it; yet it does not from thence follow, that the Ideas of Space, Outness, Distance, and of the Situation and Magnitude of Things placed at a Distance, cannot, by the Sight alone, be introduced into our Minds. Were this true, I see not how we could ever come by those Ideas; for the tangible Ideas are as much present with the Mind as the visible Ideas, and on that Account must be equally incapable of introducing

ducing the Idea of any Thing external. When with my Hand I touch an Object, the Idea perceived is present with my Mind; and in moving my Hand along the Object, or in moving my Body from one Place to another, the Ideas or Perceptions that succeed one another, are all of them as much present with my Mind as any visible Idea can be. How then can it be said, that *external Distance and Situation are only determined by the Motion of the Body, perceivable by Touch?* This is to destroy the universally received Notions we have of Things, and to confound external Space, Distance and Situation, with a Series of Ideas succeeding one another in the Mind. It is to take away all Difference between Space and Time, and to make both consist in a Consciousness of a Succession of different Ideas or Perceptions in the Mind; whereas it is certain, that neither of them depends on our Ideas, but must continue the same whether we have any Ideas or not. It is to introduce a wild and unbounded *Scepticism*, a Scepticism that at once banishes this external World and Space itself out of the Field of Existence, and in place thereof substitutes a visionary World, a World of Ideas and Phantoms existing nowhere but in his own Mind. It is to sup-
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pose that it is God who presents the Appearances of Things external to us, and that He does it in such a Manner as to deceive us; For supposing Things external to exist, I see not what greater Assurances we could have of their Existence than we now have. In fine, this is not to solve the Problem, whether it be from Custom and Experience, or by virtue of an original connate Law, that by Sight we come to judge of the Situation of external Things, but by exterminating all Things external, to make the Problem itself absurd and ridiculous.

If what has been demonstrated in the preceding *Lemma* be duly attended to, it will not be difficult to explain how Objects seen with both Eyes appear single, from their being seen by each of them in the same Place.

For illustrating this, let it be supposed that both Eyes are directed to the Point F, (See *Fig. 1.*) by the preceding *Lemma*, this Point must be seen by the left Eye in its *Axis cF*, and by the right Eye in its *Axis CF*: And since we have also a Faculty of judging of the Distance of Objects, it follows that the Point F must be seen by both Eyes in that precise Place where the Lines *cF*, *CF* intersect each other; and being seen in the same Place by both Eyes, it must

necessarily appear single, it being impossible for us to conceive two Objects existing in the same Place at the same Time.

In like manner all the other visual Points of the Object GH must also appear single; for supposing the Eyes to continue their former Direction, the Rays, which come from any other Point, as H, will be united on the *Retina* of the left Eye on the Outside of the *Optick Axis* at *a*, and in the other Eye they will be united on the Inside of its *Axis* at A: Hence the Point H will be seen by both Eyes in the Lines *aH*, *AH*, which are perpendicular to the *Retina*, at the Points *a* and A, where the Image is painted; but the Lines *aH* and *AH* meet and intersect each other at H: And therefore, since our Mind or visive Faculty has a Power of judging rightly of the Distance of Objects, it follows that the Point H must be seen by both Eyes in the precise Point H, where these Lines intersect each other; and consequently must appear single, because we can have no Idea of the Penetration of Matter; or, which is the same Thing, it is impossible for us to conceive two visible Objects placed in the same Place at the same Time.

What hath been just now said of the single Appearance of Objects seen with both Eyes,

Eyes, holds only with respect to Objects placed in the Plan of the *Horopter*; for all Objects placed out of this Plan, must, in consequence of the Principle laid down in the foregoing *Lemma*, be seen in two different Places with relation to that Point of the *Horopter* on which our Eyes are fixed; and, being seen in two different Places, must therefore appear double.

Thus, if, while the *Optick Axes*, (See *Fig. 4.*) AC , BC , are directed to a Mark C , for viewing it accurately, we attend to an Object x , placed any where within the Angle ACB formed of the *Optick Axes*, the Object x will appear in two Places; for being seen by the right Eye in the Direction of the visual Line Bx , it must appear on the left Side of C , and its Distance from C will be measured by the Angle CBx ; and being seen by the left Eye in the Direction of the visual Line Ax , it must appear on the right Side of C , and its Distance from C will be measured by the Angle CAx , and consequently it must appear double, and the Distance between the Places of its Appearance will be measured by the Sum of the Angles CBx , CAx . For the like Reason, so soon as the Eyes change their Direction from C to x , the Object x shall appear single, but all other Objects placed

placed within the Angle $D\alpha E$ made by the Optick Axes produced will appear double, Thus the Object C , being seen in the visual Lines AC , BC , which are on different Sides of the Object α , it must necessarily appear double, and the Distance between the Places of its Appearance is measured by the Sum of the Angles CAE , CBD .

The same Way of Reasoning applied to Objects in all Manner of Situations, will shew that all of them must appear double, when placed out of the Plan of the *Horo-pter*; all which is exactly agreeable to Experience: And this also is the Reason why a double Appearance will be seen when the End of a long Ruler is placed between the Eye-brows, and extended directly forward with its flat Sides respecting Right and Left; for, by directing the Eyes to a remote Object, the right Side of the Ruler seen by the right Eye, will appear on the left Hand, and the left Side on the right Hand. But we are not from this to imagine that the single Appearance of Objects placed in the Plan of the *Horo-pter*, arises from the uniform Motion of our Eyes; for while the left Eye is directed to F (See *Fig. 1.*) let the other be directed to G or H , it is plain from the preceding *Lemma*, that the Points G , F and H , will continue to be

be seen in the same perpendicular Lines EG, CF, AH they formerly appeared in, when both Eyes were directed to F; and since at the same Time we have a Power of judging rightly of their Distance, it follows that here also they must appear single from their being seen in the same Place by both Eyes.

How this agrees with the double Appearance of Objects, when either of the Eyes is, by the Pressure of the Finger, or by a *Spasm* or *Paralysis* in any of its Muscles, restrained from following the Motions of the other, will be shewn hereafter. In the mean time, from what has been already said, we may see the Reason why those who, from Use and Custom, have acquired a Power and Habit of Squinting, see Objects single as other Men.

But for the better explaining the Nature of Squinting, and from the above established Principles, to set the Diagnosticks and Prognosticks of this Disease in a juster Light than hitherto has been done, it will be necessary to take a View of the several Causes from which it may proceed, and to determine some of the chief optical Effects that naturally arise from them, whereby the preceding Doctrine will be farther illustrated and confirmed. And

First, This Disease may proceed from
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Custom and Habit, while, in the Eye itself, or in its Muscles, nothing is preternatural or defective: Thus Children, by imitating those that Squint, and Infants by having many agreeable Objects presented to them at once, which invite them to turn one Eye to one, and the other Eye to another, do frequently contract a Habit of moving their Eyes differently, which afterwards they cannot so easily correct. Infants likewise get a Custom of Squinting, by being placed obliquely towards a Candle, Window, or any other agreeable Object capable of attracting their Sight; for though to see the Object, they may at first turn both Eyes towards it; yet because such an oblique Situation is painful and laborious, especially to the most distant Eye, they soon relax one of the Eyes, and content themselves with examining it with the Eye that is next it; whence arises a Diversity of Situation, and a Habit of moving the Eyes differently.

In this Case, which may admit of a Cure, if not too much confirmed, it is evident that Objects will be seen in the same Place by both Eyes, and therefore must appear single as to other Men; but because, in the Eye that squints, the Image of the Object to which the other Eye is directed, falls not on the most sensible and delicate Part
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of the *Retina*, which is naturally in the *Axis* of the Eye, it is easy to see that it must be but faintly perceived by this Eye. Hence it is that while they are attentive in viewing any Object, if the Hand be brought before the other Eye, this Object will be but obscurely seen, till the Eye change its Situation, and have its *Axis* directed to it; which Change of Situation is indeed very easy for them, because it depends on the Muscles of the Eyes, whose Functions are entire, but, by reason of the Habit they have contracted of moving their Eyes differently, the other Eye is at the same Time frequently turned aside, so that only one at a Time is directed to the Object.

That all this may be the better perceived, for an Object, cause them to look at the Image of the upper Part of your Nose in a plain Mirror, while you stand directly behind them, to observe the Direction of their Eyes.

Secondly, The *Strabismus* may proceed from a Fault in the first Conformation, by which the most delicate and sensible Part of the *Retina* is removed from its natural Situation, which is directly opposite to the Pupil, and is placed a little to a side of the *Axis* of the Eye, which obliges them to turn the Eye away from the Object they would

would view, that its Picture may fall on this most sensible Part of the Organ. Thus if *a* (See *Fig. 1.*) be supposed the most sensible Part of the *Retina*, in order to see the Object *H*, the Eye must be turned aside to *F*.

When this is the Case, the Disease is altogether incurable, and the *Phænomena* that arise therefrom differ in nothing from the *Phænomena* of the former Case; excepting only that here, *imo*, The Object to which the Eye is not directed will be best seen, which is the Reverse of what happens when this Disease arises barely from Habit and Custom. *2do*, No Object will appear altogether clear and distinct; for all Objects to which the Eye is directed, by having their Image painted on the *Retina* at the *Axis* of the Eye, where it is not very sensible, will be but obscurely seen; and Objects that are placed so far to a side of the *Optick Axis*, as is necessary for making their Image fall on the most sensible and delicate Part of the *Retina*, must appear a little confused, because the several Pencils of Rays that come therefrom, fall too obliquely on the *CrySTALLINE*, to be accurately collected in so many distinct Points of the *Retina*, though it must be acknowledged, that this Confusion is for the most part so small as to escape unobserved.

Thirdly.

Thirdly, This Discale may proceed from an oblique Position of the *Crystalline*, as in *Fig. 5.* where the Rays that come directly to the Eye from an Object at A, and that ought to converge to the Point of the *Retina* D, which is in the *Axis* of the Eye, DE, are, by Reason of the Obliquity of the *Crystalline* made to converge to another Point, as C, on that Side of the visual *Axis* DEA, where the *Crystalline* is most elevated, and therefore the Object is but obscurely seen; because its Image falls not on the *Retina* at the *Axis* of the Eye, where it is most sensible. But the Rays that fall obliquely on the Eye, as those that come from an Object at B, will, after Refraction, converge to this most sensible Part of the *Retina* D, and by converging there, must impress the Mind with a clearer Idea of the Object from whence they came. It is for this Reason that the Eye never moves uniformly with the other, but turns away from the Object it would view, being attentive to the Object to which it is not directed. When this is the Case, it is in vain to expect any Good from Medicine.

The Symptoms that naturally arise from it are, *imo*, The Object A, to which the Eye is directed, will be but faintly seen, because its Image falls on the *Retina* at C, where

where it is not very sensible. 2^{do}, The Object B, to which the Eye is not directed, by having its Image painted on the *Retina* at the *Axis* of the Eye DE, will be clearly perceived. But 3^{tio}, This same Object B must appear somewhat indistinct, because the Pencils of Rays that flow from it are not accurately collected in so many distinct Points in the *Retina*, by reason of their oblique Incidence on the *Crystalline*. And 4^{to}, It must be seen, not in its proper Place B, but thence translated to some other Place as A, situated in the *Axis* of Vision DEA. (See the preceding *Lemma* and *Scholium*.) And 5^{to}, Being thus translated from its true Place, where it is seen by the other Eye that does not squint, it must necessarily appear double, and the Distance between the Places of its Appearance will be still greater, if the *Crystalline* of the other Eye incline to the contrary Side.

Had *Monsr. de la Hire* attended to this Translation and double Appearance of the Object, I see not how he could have imagined, that when the *Crystalline* is inclined differently in both Eyes, the Moon, for Example, will appear like two Ovals that decussate one another, as in *Fig. 6*. (See his Dissertation *sur les differens accidens de la vûe*.) For though the Moon, or any
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round Body, may appear a little oval from the unequal Refraction of the Rays in the oblique *Crystalline*, and though these Ovals may have different Inclinations arising from the different Inclinations of the *Crystallines*, yet they can never decussate one another, but being translated to two different Places must necessarily appear double and at a Distance from each other.

Fourthly, This Disease may arise from an oblique Position of the *Cornea*, which, as *Maitre-Jean* observes, in this Case is commonly more arched and prominent than what it is naturally. When the Eye has this Conformation, no Object to which it is directed can be clearly seen, because its Image falls not on the *Retina*, at the *Axis* of the Eye, and therefore the Eye turns aside from the Object it would view, that its Image may fall on the most sensible Part of the *Retina*.

To determine the Situation of the Eye, with respect to the Object it would view, let AGK be the *Axis* of Vision, (See *Fig. 7.*) and let the Arch *bGd*, whose Center is *o*, represent the oblique prominent *Cornea*, and let *aAx* be a Cone of Rays, having its *Basis* in the Pupil, and its *Apex* in the most sensible Part of the *Retina*; it is evident that this Cone must come from a Point

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without the Eye, which of all others appears most clear and distinct. To find therefore the Situation of this Point, nothing is required but to trace back the middle Ray AG, in the Line it described before its Incidence on the *Cornea* at G. For this purpose erect upon the Surface of the *Cornea*, from the Point of Incidence G, the Perpendicular GP, and having produced it downwards to Q, from A let fall upon it the Perpendicular AD, and produce it to H; so that DH may be to AD as the Sine of Incidence to the Sine of Refraction, that is as 4 to 3, and about the Center G, with the Radius GA describing a Circle AHP, draw parallel to the Perpendicular GPQ, the Line HE cutting the Circumference in E, and join EG; this Line EG shall be the Line of the incident Ray, in which an Object must be placed to have its Image painted on the *Retina* at the *Axis* of the Eye A, where it is most sensible. For if EF be let fall perpendicularly on the Line PQ, this Line EF shall be the Sine of Incidence of the Ray EG, the Angle of Incidence being EGP, and this Sine EF is equal to DH, and consequently in proportion to the Sine of Refraction AD, as 4 to 3.

When the *Strabismus* proceeds from this Cause, the Prognostick and Phænomena
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that attend it will be much the same as in the Case immediately preceding, from which nevertheless it may be distinguished by the Obliquity of the *Cornea*, which is manifest to the Senses; and if the *Cornea* be also more arched and prominent than what it is naturally, which is commonly the Case, the Eye will also be short-sighted.

Fifthly, This Want of Uniformity in the Motions of our Eyes may arise from a Defect, or any great Weakness or Imperfection in the Sight of both, or either of the Eyes.

It will afterwards be made appear, that the Motions of our Eyes are voluntary, and depending upon our Mind, which being a wise Agent, does will them to move uniformly; not from any absolute Necessity in the Thing it self, or for want of Power to move them differently; but because of the Utility and Advantage that arises from such Motions. Hence Children, for some time after Birth, may be observed to look differently with both Eyes, till from the Advantage they find in moving them the same Way, they come at length to move them always uniformly; which uniform Motion does at last become so necessary, as to render any other Motion impossible, it being certain that Custom and Habit does

render many Actions necessary which are not essentially so.

This being the Case with respect to the uniform Motion of our Eyes, it follows that when the Sight of both or either of the Eyes is so defective, weak or imperfect, as to disappoint us of the Advantages that naturally arise from their uniform Motion, the Mind will not accustom itself to this sort of Motion, but will preserve its natural and connate Liberty of moving them differently. An Example of this may be had in those who, from a *Cataract* or *Gutta serena*, have been blind from the Birth in both or either of their Eyes; and that the same thing may also happen when the Disease is of a later Date, seems evident from what *Plempius* observes (*Optalmograph. lib. iv. Problem. 13.*) of a Girl who became blind from a *Gutta serena* in the fifth Year of her Age: This Girl finding no further Advantage, after being blind, in moving her Eyes the same Way, came at last to forget the Habit she had formerly acquired in the four Years she saw, and moved her Eyes differently, sometimes their *Axes* being parallel, sometimes converging, and at other Times diverging.

The *Prognostick* in this Case is the same with that of the Disease from which it proceeds;

ceeds, and the *Phænomena* are so obvious from what has been already said, that to say any more, would be but to make Repetitions.

Sixthly, Another Cause from which the *Strabismus* may proceed, lyes in the Muscles that move the Eye. When any of those Muscles are too short or too long, too tense or too lax, or are seized with a *Spasm* or *Paralysis*, their *Equilibrium* will be destroyed, and the Eye will be turned towards, or from that Side where the Muscles are faulty.

In this Case, the Disease frequently yields to Medicine, and therefore admits of a favourable Prognostick; excepting only when by a Fault in the first Conformation, any of the Muscles are longer or shorter than their Antagonist; in which Case, if ever it should happen, no Medicine can be of any Value.

As to what concerns the *Optical Phænomena* they are the same here as in Case first; only when the Disease commences not till, by Custom and Habit, the uniform Motion of the Eyes has been rendered necessary, all Objects do for some Time appear double, of which we have given some Examples above.

To explain how this should come to pass, and at the same Time to reconcile it with what has been formerly said, from p. 192,

to p. 239. concerning the single Appearance of Objects seen with both Eyes, where I have demonstrated that this single Appearance does not depend upon the uniform Motions of our Eyes, is a Matter of very great Difficulty, and therefore deserves well to be carefully examined.

It hath been shewn that Objects are seen without the Eye, in Lines drawn perpendicularly to the *Retina*, from that Point of it where their Image is painted; it hath likewise been demonstrated that these Lines continue invariably the same without any Change of Situation, though the Eye be turned away from the Object to which the other Eye is directed: Whence it seems to follow, that the Object in all Situations of the Eye should continue to be seen in the same Place by both Eyes; and being seen in the same Place, should always appear single; How comes it therefore that, in the Case before us, the Object should appear double? What is it can put this Cheat upon the Understanding? Whether the Eyes look the same Way or differently, the Object appears to each of them in the same Lines; and since at the same Time we also perceive its Distance, it ought to appear single, because seen in the Concourse of these Lines, and yet it is esteemed double; Herein con-

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sists the Difficulty, which does vanish and admit of a most easy Solution, if we but consider that the Mind mistakes the Situation of the Eye, and supposes that it is directed to the same Object with the other; for having been accustomed to move both Eyes uniformly, from which a kind of Necessity has arisen that makes it impossible for us to move them differently, when we would view any Object, the Mind wills both Eyes to be directed towards it, and not being sensible that either of them has disobeyed its Commands, it concludes that they are both turned the same Way, because it has been accustomed to find them so upon the like Occasions: And being thus mistaken as to the Situation of the Eye, it must also be mistaken as to the Situation of the Object seen by it, which therefore must appear double, by reason of the different Situation it appears in to each Eye, it being impossible for us to conceive that any one Thing can be in two different Places at the same Time.

To illustrate this Matter, let it be supposed that one wills both Eyes to be directed to F, (See *Fig. 1.*) for viewing it accurately, and that while the left Eye gives ready Obedience, let the other by reason of a recent Defect in some of its Muscles, be turn-

ed to H: It is plain that the Point F will be seen in the same perpendicular Line CF it would have appeared in, had it been directed to F; but because this Line, by reason of the Obliquity of the Eye, does not fall on the *Retina* at its *Axis* C, but at some other Point on the Outside of this *Axis* as E, so that the Angle CoE may be equal to the Angle FoH, it will itself appear translated to EG, and being thus translated, the Point F must be translated with it, which therefore will be seen, not in its proper Place F, but in some other Place as G, situated in the Perpendicular EoG. For since the Mind knows not but the Eye is directed to F, it must form the same Judgment with respect to the Situation of Objects, as if it were really so: But it has been already shewn, that Objects are always seen by virtue of a connate immutable Law, in Lines drawn perpendicularly to the *Retina*, from that Point of it where their Image falls, and therefore the Object F having its Image painted on the *Retina* at E, must be seen by this Eye, which the Mind supposes directed to F, somewhere in the Perpendicular EG, as at G; while to the other Eye it appears in its true Place F: And, being thus seen in two different Places G and F, it must necessarily appear double.

Some-

Something like this happens when an Object is felt, by the Extremities of two Fingers that are made to cross each other; for the Mind, not attending to the Position of the Fingers, judges that the Object is double; because it is felt by those Parts of the Fingers that use to be at a Distance from each other.

That we have here given the true Account of this *Phænomenon*, will be further evident to any one who considers, that when the Mind does not mistake the Situation of the Eye, as in those who by Custom have from their Infancy contracted a Habit of moving their Eyes differently, all Objects appear single as to other Men; and this likewise is the Reason why, in the Case before us, all Things come in time to be seen single: For, by repeated Experiences, the Mind becomes wiser, and, by Degrees, learns to form a right Judgment concerning the Direction of the Eye, which Judgment, by becoming habitual, must serve to correct the Mistake it was formerly led into, with respect to the Situation of Objects. The ingenious Mr. *Cheselden* gives us a very beautiful Example of this in his System of Anatomy; his Words are, “ A Gentleman
“ who, from a Blow on the Head, had one
“ Eye distorted, found every Object ap-
“ pear

“ pear double; but by Degrees the most
 “ familiar ones became single, and in Time
 “ all Objects became so, without any A-
 “ mendment of the Distortion.”

The not considering of what has been said, has been a fundamental and perplexing Oversight; for Proof whereof, we need go no farther than the Case before us; for explaining which, many learned Men have been forced to suppose, that by Sight alone we can never form any Judgment with respect to the Situation of Objects, without calling in the Experiences of Touch, the contrary of which has been set forth at large, and demonstrated in the preceding *Scholion*.

From all that has been said on this Head laid together and duly considered, we may clearly deduce this Inference: The double Appearance of Objects that happens when either of the Eyes is, from a *Spasm* or *Paralysis* of any of their Muscles, or from any other Cause, restrained from following the Motions of the other, does not prove, that to see Objects single, it is absolutely requisite that both Eyes be directed to the same Object, and that this is one of the final Causes of their uniform Motion.

Lastly, This Want of Uniformity in the Motions of our Eyes may proceed from a
 preter-

preternatural Adhesion or Attachment to the Eye-lids; of this we have already given an Example from *Langius*. And that the same Thing may also be occasioned by a Tumor of any Kind within the Orbit, pressing the Eye aside, and restraining it from following the Motions of the other, is so evident, that I need not bring Instances to prove it; those who desire such, may consult Observators. Here also the Case may admit of a favourable Prognostick: And as for what concerns the *optical Phænomena*, they must be the same as in the Case immediately preceding.

Having finished what I intended to say concerning the final Causes of the uniform Motion of our Eyes, I come now to enquire into the efficient Cause of this Uniformity, or by what Necessity it happens that both Eyes are always turned the same Way, so that none of us are able at pleasure to give them different Directions.

Aristotle of old, and after him *Galen*, *Avicenna*, and most of the Ancients, do attribute this to the Union of the Optick Nerves, near the *Sella ossis Sphenoidis*; but since these Nerves give no Branches to the Muscles, but are wholly bestowed upon the *Retinæ*, it follows that they can contribute nothing towards the Motion of our Eyes,
but

but are only for conveying to the Mind, or visive Faculty, the Impressions made upon their Fund by the Rays of Light. Hence it is, that in Blindness from Obstructions in those Nerves, the Eyes continue to move as formerly ; because their Motion does not depend upon the Optick Nerves, but upon their other Nerves and Muscles. But supposing that the Optick Nerves did contribute to the Motion of our Eyes, yet their Conjunction could never occasion this uniform Motion ; because, as *Diemerbroek* observes, (See his Anatomy, *lib. iii. cap. 16.*) Anatomists have found them disjoined in some Subjects, who, while alive, moved their Eyes uniformly as other Men.

It is therefore with good Reason that our Moderns have rejected this Hypothesis as false and groundless ; but neither have they themselves succeeded better, when they tell us, That this happens because the Nerves bestowed upon the Muscles of our Eyes, called *Oculorum motorii*, are united at their Origin in the Brain. Every Body knows that our Fingers are at Liberty to execute different Motions, and to be extended separately, though not only the Nerve, but also the Muscle subservient to their Extension is but one : Whence therefore this Liberty should be denied our Eyes, whose Muscles

are

are distinct, I see not. But this is not all; for there are many Parts of the Body, which though they have Nerves of different Origins, yet they necessarily move together. Thus the Eyes cannot be turned up or down, but the Eye-lids follow their Motion, and keep at the same Distance from the Pupil, tho' at the same Time the Eye-lids can be moved without any Motion in our Eyes. Did this uniform Motion depend upon any Union or Conjunction of the *oculorum motorii*, or of any of our other Nerves, none would squint but such as had them disjoined; and it would be in vain to use any Precaution against Childrens taking up such a Habit, or to endeavour to correct it.

The true Cause of this Uniformity in the Motions of our Eyes to me seems wholly to depend on Custom and Habit. For it is not to be doubted but these Motions are voluntary, and depending upon our Mind, which, being a wise Agent, wills them to move uniformly, not from any intrinsical Necessity in the Thing itself, or for Want of Power to move them differently; but because such Motions are most profitable and useful to us. So that our Opinion is, that the uniform Motion of our Eyes is not at first necessary, but that the Mind has imposed upon itself that Law founded upon the Utility

Utility and Advantage that arises from this Sort of Motion ; which Motion does in Time become so necessary, that none of us are now able to move one Eye towards any Object, but the other is likewise turned the same Way. And as for other Creatures who move their Eyes differently, such as the *Chameleon*, which has this Faculty in an eminent Manner, so that the one Eye is moved, whilst the other remains immovable ; the one is turned forwards, at the same Time the other looks behind ; and the one looks up to the Sky, when the other is fixed on the Ground. I say, as for other Creatures that move their Eyes differently, such as the Hare, *Chameleon*, &c. it is evident, since the Organs subservient to those Motions are the same as in Man, that it is the Utility and Advantage they receive from these particular Motions, which determines that Principle which governs and rules all their Motions, to actuate the Organs in such a Manner as those Motions, which they find most profitable and necessary for them, may follow.

Dr. *Goddart* (in the *Philosophical Transactions*) has observed, that the Eyes of the *Chameleon* resemble a *Lens* or convex Glass, set in a versatile globular Socket, of which our *Parisian* Academists have taken

no Notice. But be this as it will, they found that they were moved by true Muscles, which as in other Creatures are interted under the *Conjunctiva*; so that it seems *Panarolus* was mistaken, when, as *Bartholin* informs us, (*Hist. Anat. rar. Cent. 2. Hist. 62.*) He says that their Eyes want Muscles, and that they are moved by the Corrugation of a Membrane, which is contracted by means of circular Fibres. What might have led him into this Mistake, may be guessed at from the Observations of the same Academists, who tell us, that the Eyes, which are very large, jut out full Half of their Ball, and are covered with one single Eye-lid, made like a Cap pierced through the Middle, with a Hole not exceeding one Line in Breadth. This Eye-lid was found fastned to the fore Part of the Eye, by means of an orbicular Muscle that was spread over the whole *Tunica conjunctiva*, to which, as well as to the Eye-lid, it was so adherent, that it served to give the same Motion to the Lid as to the Eye, tho' its particular Action was to contract the little round Hole of the Lid, which closes by enlarging itself cross-ways, even to the making one single Slit, which very exactly unites the upper Part with the lower. Seeing then that the Eye cannot be moved, without communi-

cating

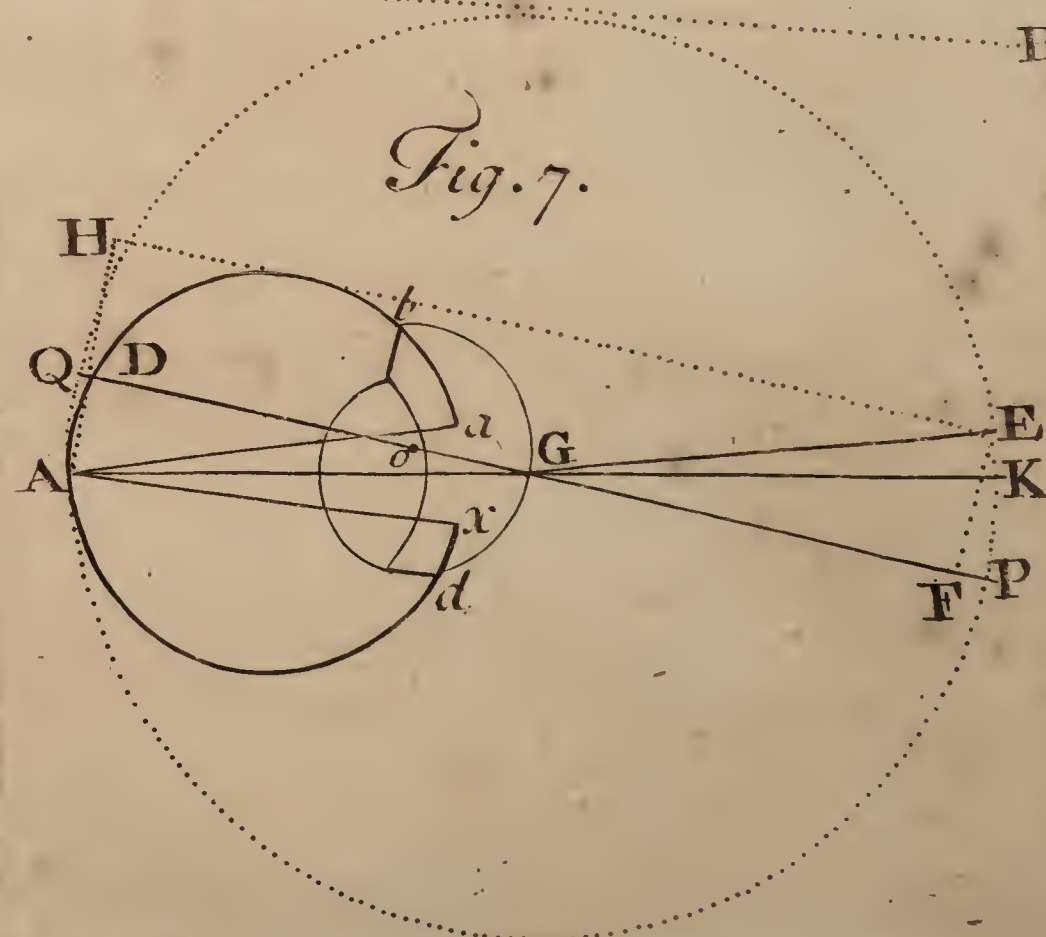
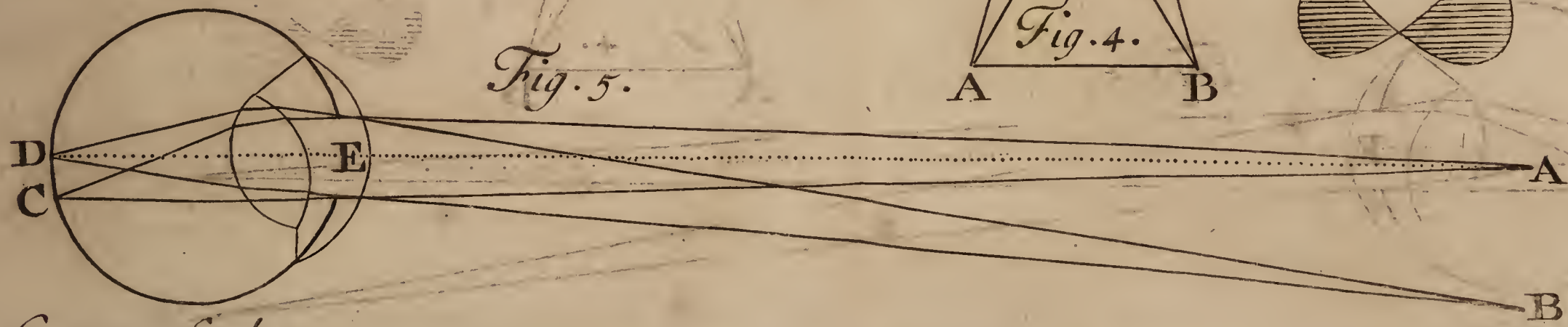
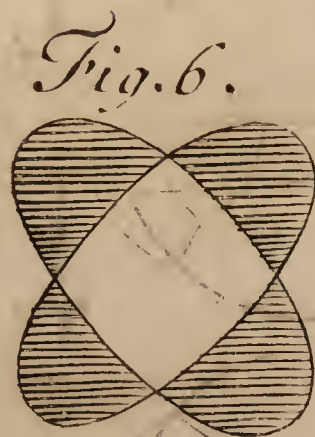
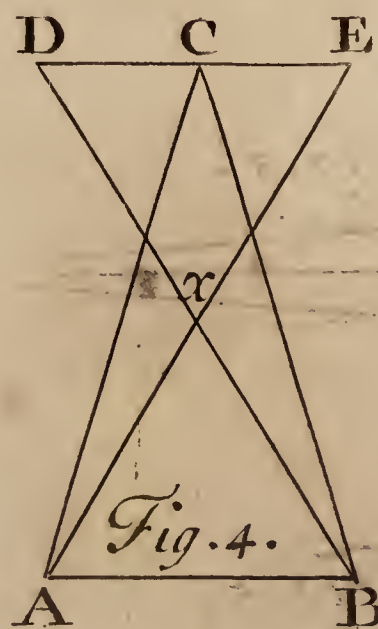
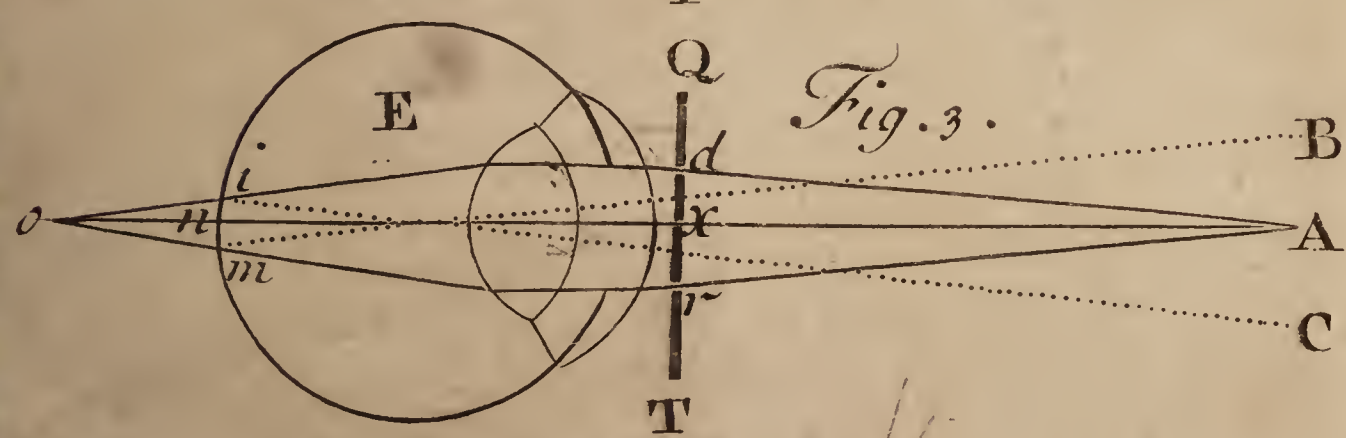
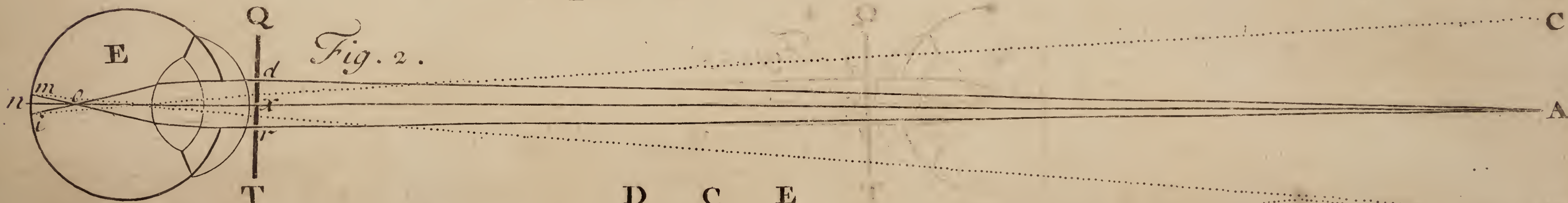
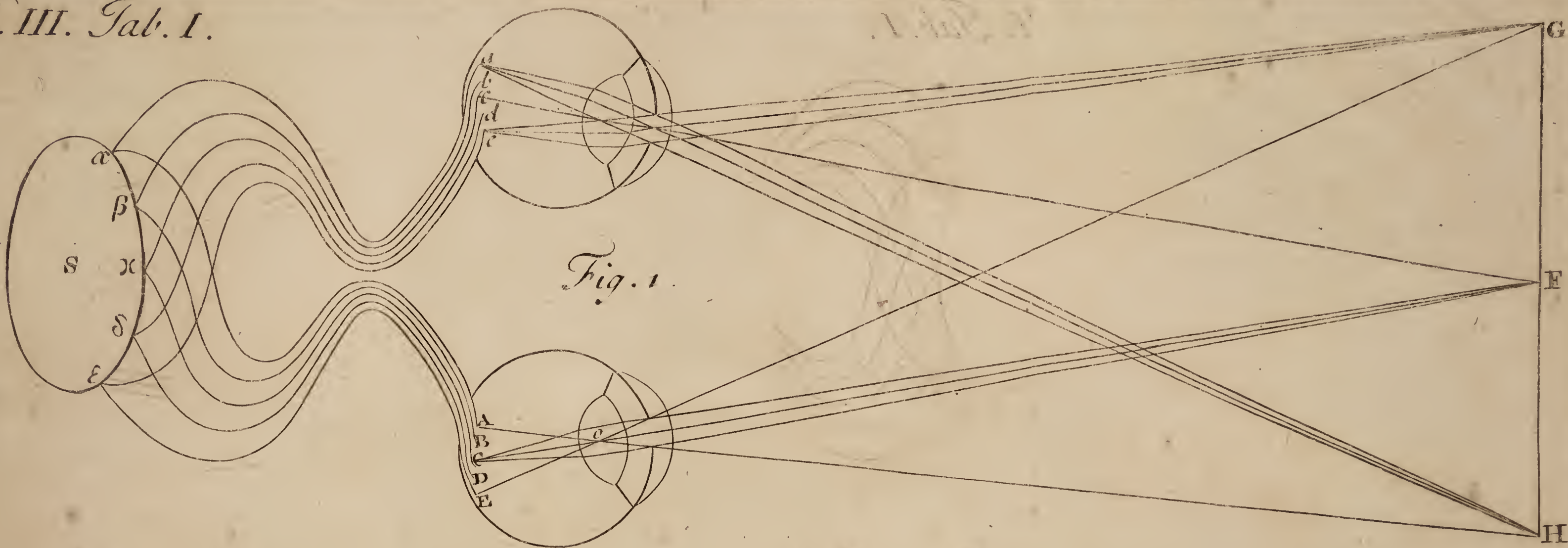
cating the same Motion to the Eye-lid, which must therefore appear corrugated, it is probable that *Panarolus*, for want of due Scrutiny after the Muscles, might have imagined that the Motions of the Eye proceeded from the Corrugation of this Membrane, which is indeed contracted by means of the circular Fibres of the orbicular Muscle. But supposing *Panarolus*'s Observation to have been just, it is all one with respect to the present Case ; for the dissimilar Motion of their Eyes arising from the dissimilar Contraction of those circular Fibres, can have no Foundation, but in the Utility and Advantage that arises from such Motions which might as well have been executed by Muscles. Nor can any good Reason be assigned why the Mind, which presides over all the animal (*if not also the vital and natural*) Motions, should not be at Liberty to contract this or that Muscle independently of others, as well as to contract this or that Fibre independently of others, especially when we find it frequently does so in other Creatures, such as Fishes, Birds ; and amongst Quadrupeds, the Hare, Cony, &c.

And as the Hare, Chameleon, &c. have a Power of moving their Eyes differently, so neither is there any Room to doubt, but that at first we our selves are also possessed of

of the like Power ; as is evident from the Observation, already mentioned, of Children, who, for some Time after Birth, can look different Ways with their Eyes ; which Power they retain, till by discovering the Advantage of directing them the same Way, they come to move them always uniformly. This uniform Motion by Use and Habit at last becomes so necessary, that the Eyes cannot be moved differently ; long Custom rendring many Actions necessary, which were not so essentially, nor from the Beginning.

I have already given an Example of this in the Motions of the upper Eye-lid, which always follows the Motions of the Eye, and keeps at the same Distance from the Pupil, whether the Eye be turned up or down. The same Thing may also happen the Fingers ; for if one is not accustomed to move any of them but in Conjunction with the rest, it will not be in his Power to move them separately. Hence it is that most People cannot bend their Ring-finger towards the Palm of their Hand, but the little one shall follow its Motion. If any Body desires more Examples of this Kind, let him try to elevate one of his Eyebrows, while the other is depressed ; let him try to dilate one of his Nostrils, or one

Side of his *Thorax*, while the other is contracted; or, if he can, let him contract the Muscles on one Side of his Belly, while those on the other Side continue relaxed. I remember a Time when it was very difficult for me to shut any one of my Eyes, while the other was open, which now is very easy for me, because I have accustomed my self thereto; and this frequently happens, even in the Eyes themselves: For if we accustom our selves to direct them different Ways, as Boys do often in imitating those that squint, we shall in Time be able to squint without Difficulty, especially if young. This is further confirmed from the dissimilar Motions of the Eyes that are so frequently observed in blind People, and particularly by that History, already quoted from *Plempius*, of a Girl who losing her Sight, and having therefore no longer any Advantage from the uniform Motions of her Eyes, came at last to move them differently. Hence it is that Children, the younger they are, are the more apt to become goggle-ey'd; because, when young, they have not so much accustomed themselves to look the same Way with both Eyes, as to render that uniform Motion necessary; and therefore do frequently become goggle-ey'd, by having many pleasant Objects presented to them





them at the same Time, which invites them to turn one Eye to one Object, and the other Eye to another: And thus they contract a Habit of moving their Eyes differently, which is apt to continue all their Life-time, if not timely corrected. *Willis* has observed this (in his *Anima Brutorum*, cap. 15.) in these Words, *Quare infantes, quando ipsorum oculis multæ res simul ob- jiciuntur, strabismus facile contrahunt.*



XIII. *Supplements to Art. XI. of Vol. I. and to Art. IX. and XIII. of Vol. II. by ALEXR. MONRO Professor of Anatomy in the University of Edinburgh.*

HAVING conversed with some younger Anatomists, whose Imagination could not supply the Want of a Figure to explain what I wrote in *Art. XI.* of your first Volume, concerning the *Digastric* Muscles, I beg you would, on their Account, publish the inclosed Figures, with a Reflection or two on them, as a Supplement to that Paper.

Tab. II. Fig. 1. is a Copy of as much of *Cowper's Tab. 23. Myot.* as relates to the Parts in question, with the Addition of

two or three pricked Lines; the View here represented being a direct one of the left Side, with the Head reclined towards the right, and the Muscles in an unactive State.

A denotes the Base of the lower Jaw, to which the anterior Head of the *Digastric* Muscle is fixed.

B, The Part of the temporal Bone from which the other Head of the *Digastric* rises.

C, The *Os hyoides*.

D, The internal jugular Vein filled with Wax.

E, The anterior Head of the *Digastric* Muscle.

F, The posterior fleshy Belly of the same Muscle.

G, g, The middle Tendon common to both these Heads.

H, A strong *Aponeurosis* sent from that Tendon to the *Os hyoides*.

i, Part of that Tendon raised into a Convexity forewards, by the over-distended jugular Vein.

K, The *Stylo-hyoid* Muscle, through which the Tendon of the *Digastric* passes.

L, The Extremity of the *Stylo-hyoid* Muscle, that is fixed to the *Os hyoides*.

Fig. 2. Represents the direct anterior View

View of the *Stylo-hyoid* and *Digastric* Muscles, with the *Os hyoides*, when the Head is drawn much back.

The Letters common to this Figure, with the former, denoting the same Parts, a Comparison of the two Figures will shew what the Effect of the different Attitudes is.

Besides what is common to both, *q, q*, here point out the great Curve of the round Tendons, to be at the same Part where the strong *Aponeurosis* *H* goes off to the *Os hyoides*.

P, Is the thin *Aponeurosis* of the *Digastric* Muscles, spread upon the *Mylohyoid* Muscles.

You see then that Mr. Cowper paints no ligamentous Pulley here for the round Tendon of the *Digastric* Muscle to move in; nor has he any in *Tab. 31. Myotom.* where the *Digastric* is again represented; but in both he delineates the *Aponeurosis* fixed to the *Os hyoides*, which he mentions in his Description, *Num. 68.* as a constant Thing, as I always find it. But he is obliged to acknowledge (notwithstanding the Fondness he expresses for being the first who shewed the Mechanism by which the *Digastrics* act on the lower Jaw) that the Tendon passes through the *Stylohyoideus*, and an annular Ligament or some-

times a membranous Inclosure. I still affirm, that I never saw any Ligament, such as ties down the Muscles of the Hand, Fingers, Foot, Toes, or any other Muscle, whose Action is determined by a Band or Ligament, to any Direction different from the straight Course of its fleshy Fibres, and that what is called the annular Ligament of the Tendon of the *Digastrick* Muscle, is no other than the common cellular Membrane, which stretches with the least Force drawing it, and readily rises into Cells upon blowing Air into it.

Some have fancied that the *Stylohyoides* Muscle serves as a Pulley to the Tendon of the *Digastric*; but any who have ever dissected Muscles, must know that their fleshy Fibres are connected to each other by such weak Fibres, as can make very little Resistance; and in dissecting this Part of the *Stylohyoides* Muscle, we scarce can hold it with a Hook or Forceps so tense as to dissect it clean, without the Risk of tearing its Fibres asunder, which plainly shews it to be too weak for the Use they assign it. They ought to have also considered, that the Tendon has no Curve where it passes through this Muscle, which is a sure Sign that the Muscle does not serve as a Pulley to it.

Tho' there was a Pulley through which
this

this Tendon passed, it could be of no Use, so long as the Tendon is tied to the *Os hyoides*; for the *Aponeurosis H* hinders its Play in the same Way as Threads tied to a Cord laid over a Pulley, and to the Screw or Ropes by which the Pulley is suspended, prevent the Motion of the Cord.

One may readily judge from the Figures what the Action of this *Digastric* Muscle must be. If the posterior Head, *F*, alone act, the middle Tendon will be drawn backwards till the *Aponeurosis* shuffles from *m* to *o*, which is a very small Space in Mr. *Cowper's* Figure, and must be much less in mine, after which this Head acts on the *Os hyoides*.

The anterior Belly, *E*, acting alone, the Extremity of the *Aponeurosis H* is brought from *m* to *n*, which is as much as this Head could be expected to contract.

If both Heads act while the *Os hyoides* is not kept down, the Muscle becomes straighter, approaching the Line *r*, till its *Axis* is placed in that Line, which I have endeavoured to prove is the proper Office of this Muscle in Deglutition, in which it is assisted by the *Stylo-hyoideus*, *K*.

If both Heads contract while the Muscles, which pull the *Os hyoides* down, are in Action, the Tendon *G* will be raised to-

wards *r*, till the *Aponeurosis H* is made straight and tense. Both Bellies then continuing to contract in this Situation, they will conspire in their Efforts to draw the *Os hyoides* upwards; besides which, the anterior Head pulls also the Jaw *A*. Before the Jaw can be depressed, the *Os hyoides*, *C*, must be so firmly kept down by its Muscles, that it shall be more difficultly raised than the Jaw can be depressed, otherwise *E* would move the *Os hyoides* upwards, without any Effect on the Jaw. Since therefore the Jaw can be depressed with no greater Force than what is employed to pull the *Os hyoides* down, it will necessarily follow, that whatever diminishes the Force pulling the *Os hyoides* down, must hinder instead of assisting the Depression of the Jaw. But, in the present Supposition of both Heads of the *Digastrick* Muscle contracting in the Situation above-described, it is evident that the posterior Head can have no Effect on the Jaw, but exerts its whole Force in pulling the *Os hyoides* upwards, by which it counteracts the Muscles, *i. e.* diminishes the Force that draws the *Os hyoides* down (which the anterior Head cannot increase) and consequently the Jaw is depressed, or the Mouth is opened with less Force, when the *Digastric*
Muscle

Muscle contracts, than when it is unactive: From all which, especially if joined to the Experiments mentioned in the Article to which this is a Supplement, it appears evident to me, that the Depression of the Jaw is no more the Office of the *Digastric* than the Extension of the Fore-arm is the Office of the *Brachæus internus*.

LEST any should charge me with the Omission of Experiments which contradict the Doctrine I defend in § 16. of preliminary Facts in *Art. IX.* of your second Volume, I beg you would allow me to mention some that have come to my Knowledge since you published that Essay on the Nutrition of *Fætuses*.

Blasius (a) quotes *Slade* for saying, “ The
“ *Placentulæ* of Cows have more and
“ larger Vessels than the *Cotyledons*; and
“ if a black Liquor is injected into the Ar-
“ tery which is sent to a *Placentula*, the
“ *Cotyledon* remains white. The Liquor
“ injected into the arterious Vessels of the
“ *Uterus* was carried to the *Cotyledons*,
“ and, by the Cavities of the *Cotyledons*,
“ into the Substance of the *Placentulæ*.”

Drake

(a) *Anat. Animal.* p. m. 122.

Drake (a) affirms, That *Mr. Cowper* proved the *Anastomosis* between the Vessels of the Womb and *Secundines*: “ For, “ says he, by pouring Mercury into a “ Branch of the uterine Artery of a Cow, “ that went into one of the *Cotyledons* of “ the *Uterus*, he filled those Branches of “ the umbilical Veins which went from “ that *Cotyledon* to the Navel of the *Fæ-* “ *tus*, which, with a Part of the *Uterus*, “ he keeps prepared by him.”

Slade, you observe, acknowledges that he could not make his Liquor pass from the Placentary Vessels into the Uterine; and the Passage of the Liquor from the Uterine is loosely said to have been into the Substance of the *Placenta*.

After *Drake* has mentioned what is above, he goes on to shew, from the great Analogy of the Parts, how weak an Objection it would be to alledge, “ that the Observation and Experiment being made on “ the Uterus of a Cow, the Inference would “ not hold from thence in a Woman.” From which it would appear, that I judged right of *Mr. Cowper*’s not having seen what he so loosely affirms in the Passage quoted from his great Anatomy, concerning the Communi-

(a) Anthropol. nov. Book 2. chap. 7.

munication between the human *Uterus* and *Placenta* being proved by the pouring of Mercury. It is also a little odd that *Cowper*, in his large Book, takes no Notice of this Preparation described by *Drake*, though he mentions some other Preparations of the same Parts in Cows.

I have tried the Experiment a great many times in both *Slade* and *Cowper's* Manner, but never could force one Drop of a coloured Liquor, or of Quick-silver, into any Branch of the umbilical Veins, though they passed from the *Cotyledons* into the Substance of the *Placentulae*, that is, into the Interstices of their unequal Surface, till they appeared altogether of the Colour of the injected Substance, and the Weight of the Mercury separated the *Placentulae* from the *Cotyledons*; which I think warrants me to say, that some Mistake is committed by *Dr. Drake*, or at least that *Cowper's* Subject had these Vessels disposed differently from what they are commonly in Cows.

In *p. 141*. I suspected *Mangetus* to have been inaccurate, in relating *Vieußsens's* Experiment, and now being shewn a *Geneva* Edition of *Verheyen's* Anatomy, where *Excerpta è Raymundi Vieußsenii D. M. Epistolâ ad excell. Prof. celeb. Medic. Facultatum Patavii & Bononiæ, Anno*
1705,

1705, *Monspeli typis excusâ*, are printed. I see my Suspicion was well founded; for *Vieussens* says, “ he tied the left Carotid
 “ Artery of a living Bitch with young, and
 “ then having put a small Ivory Funnel in-
 “ to the right Carotid, he poured Quick-
 “ silver at different Times towards the
 “ Head, till it amounted to about four
 “ Pounds. By the Time this Quick-silver
 “ was poured in, the Creature appeared to
 “ be quite dead, and he dissected her be-
 “ fore a great many Witnesses.” After
 describing the Progress which the Quick-
 silver had made in the Vessels of the Bitch,
 he has these Words, *Mirum dictu! Fluidum hocce corpus, nullo rupto vase, & ne unâ quidem guttâ sanguinis effusâ, placentam unumquemque Catulum obvolv-
 tem permeavit, & in ipsas umbilicales ve-
 nas protrusus fuit: Ipsummet fluidum corpus cavitates cordis, stomachi, vesicæ felleæ, intestinorum & vesicæ urinariæ ingressus est. Protrusus à me in arteriam carotidem dextram Mercurius, in arterias & subinde in ductus lactiferos mammarios sese immisit, ut supra indicavi.* In my Opinion no more of this relates to the *Fœtus* than, “ That Fluid, the Mercury, with-
 “ out breaking any Vessel, or the Effusion
 “ of one Drop of Blood passed through the
 “ Pla-

“ *Placenta*, furrounding each Whelp, and
“ was pushed into the umbilical Veins
“ themselves.” What follows being applicable only to the Mother’s Organs, as appears by the Reference to what he has said above; and by the Account he gives of this Experiment in another Treatise printed also with that Edition of *Verheyen*, where (a) in treating this Question concerning the *Anastomosis* of the Uterine and Placentary Vessels, he says no more than, “ Mercury
“ being poured into the right Carotid Artery of a Bitch about two Months gone
“ with Whelp, the left Carotid being tied,
“ passed into the umbilical Vein of the
“ Whelps without any breaking of the
“ Vessels.”

Vieussens’s Experiment seems strangely contrived; for by tying one Carotid, and putting a Funnel into the other, he left only the vertebral Arteries to propel the Blood and Quick-silver through the Vessels of the Head, from which they were to return to be distributed through the whole Body. Some of the Blood of the Vertebrales must have had a retrograde Motion into the Carotids by their *Anastomoses*, to hinder the Entry of the Quick-silver. And if the
Head

(a) *Dissertatio de structura & usu Uteri & Placentæ mulieris* § 80.

Head of the Bitch was laid so depending as the Weight of the Mercury could overcome the Resistance of that Blood, then this ponderous Liquor must have passed through the tender very small arterious Vessels of the Brain, and have ascended in the Veins contrary to its own Gravity.

It may be observed that the Quick-silver, which in his Account of the Dissection penetrated so many fecerning Organs to pass into the Cavities of the different hollow Bowels of the Body, is said in loose Words to have passed through the *Placenta*, and to have been pushed into the umbilical Veins, which the Appearances in the dead Bitch, on which I made the Trial of this *Anastomosis*, might easily have led him to think, though a nicer Examination would have discovered his Mistake. I endeavoured lately to imitate *Vieußens's* Experiment on a living Bitch, but the Creature dying before any Success could be expected, I immediately repeated the Trial I had formerly made, and with the same Success, not one Drop of Quick-silver being seen in any Branch of the umbilical Vessels of five Whelps which the Uterus contained, tho' not only the Arteries, but the Veins also of the Womb were distended with the Mercury.

Nay, *Vieußens's* Words, taken in the most
fa-

favourable Sense, are not conclusive for an *Anastomosis*, because while the Mother and Foetuses were alive, some of the Quick-silver might be taken up with other Liquors by the absorbing Vessels of the *Placenta*.

Having quoted *Vieußens* against a Doctrine I endeavoured to support, I may be allowed to transcribe a Passage or two from him that are favourable to me, § 51. *Dissert.*

de struct. & usu Uteri, &c. speaking of an impregnated *Uterus*, he has these Words,

“ It is observed that Quick-silver, injected
“ into the Arteries of the Womb, does not
“ run into its Cavity, unless when its Sub-
“ stance is strongly pressed with the Fin-
“ gers; for then some Parts of the Mercu-
“ ry fall into the Womb by the Pores in
“ the Coats of the Lymphatico-arterious
“ Canals that form its internal Surface.”

§ 56. “ This (the Effusion of Blood at
“ Birth) without Doubt was also the Cause
“ why several old Anatomists, who were
“ little acquainted with the natural Oeco-
“ nomy of the human Body, yea and Mr.
“ *Mery* believed that the Arteries of the
“ Womb directly opened into the Veins
“ of the *Placenta*, and that the Arteries
“ of the *Placenta* opened into the Veins
“ of the Womb; from which they conclu-
“ ded, that the Mother’s Blood circulated

“ into

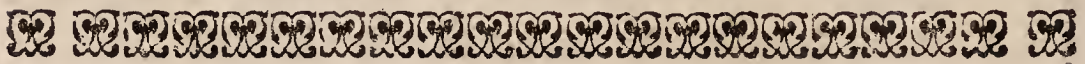
“ into the Body of the Foetus, and that the
 “ Blood of the Foetus passed into the Mo-
 “ ther’s Body. But the Falsity of this Opi-
 “ nion, which was refuted by many Anato-
 “ mists of the last Century, who were not
 “ only skilful Dissectors, but very learned
 “ natural Philosophers, shall be most evi-
 “ dently demonstrated from what I am to
 “ say, when I explain the internal Structure
 “ and the Use of the *Placenta*, so that the
 “ Abettors of it will readily reject it.”

Though *Vieuassens* endeavours only in these Passages, and several others, to re-
 dargue the common Notions of the *Anastomo-
 sis*, instead of which he pretends to esta-
 blish a Communication by the means of cer-
 tain Pores in the Sides of the Vessels; yet
 he declares strongly for § 17. of the preli-
 minary Facts in my *Essay*, that is, he will
 not allow that any red Globules pass from
 the Mother to the Foetus, or from the Fœ-
 tus to the Mother. In Confirmation of
 which, I shall relate what I observed lately
 in injecting a human *Placenta*, the Mem-
 brane of which on the Side next to the *U-
 terus*, was very entire. After I had for-
 ced out the Blood, by macerating it in
 warm Water, and injecting such Water by
 one of the umbilical Arteries, I tied the o-
 ther Artery, and the Vein by which the Wa-
 ter

ter had returned, and then turning the villous Side of the *Placenta* uppermost, I injected more Water at the Artery in which my Pipe was fixed. The Water ouzed at such small Orifices of the villous Surface, that we could not distinguish them; and it came out so slowly, that I had not Strength enough to continue to push the Sucker till the Syringe was near empty, though it contained only about eight Ounces of Liquor. I afterwards pressed the Water out of the Vessels, as much as I could, and injected Oil of Turpentine coloured with Vermilion, which returned by the Vein of a fainter Colour than it was in the Arteries; I could make very little of the Oil ouze out at the villous Coat, and what did come out was not in the least tinged. The coarser Injection being afterwards thrown into one of the Arteries, filled both, but did not return by the Vein, which I filled with the green injecting Liquor.

WHEN I wrote *Art. XIII.* of your Second Volume, I believed it to be the only Instance of a Cure of the opened Salivary Duct, by an artificial Perforation into the Mouth; but have since read *Saviard's* Book of Chirurgical Observations, in *Obs.* 121. of which *Mons. de Roy* communicates
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the History of such a Cure performed by a Perforation made with an actual Cautey: Upon comparing the two Methods, you'll easily judge which is preferable.



XIV. *An Account of a Child born with the Urinary and Genital Organs preternaturally formed; by Mr. JAMES MOWAT Surgeon at Langholm.*

IN November 1732, a Child was brought forth, whose *Funis Umbilicalis* was tied to the upper Edge of a deep Hole, at the Place marked C, (See *Tab. II. Fig. 3.* where all the Parts are represented of the Size they now are of;) and just above the *Ossa Pubis* this deep Hole penetrated the *Peritoneum*; but now a Lump of spongy Flesh D rises out of it. The Edges of the Hole were at first and are now found. From the spongy Flesh of this Hole arise two *Papillæ* A, B, about the Size of the Point of an ordinary Probe: At which the Urine continually ouzes; but when the Child cries, the Urine jets out as Blood from the Aperture of a small Artery. The *Papilla* on the left Side at A is now closed, but the other at B keeps open as at first, through which the Urine continually ouzes, and

ical-

scalding all the Parts, keeps them very raw.

The *Penis* arises immediately at the under Side of the Hole, is now of the same Bulk with the Figure G, but was at first much less; it was and still is imperforated, and flat upon the upper Side next the *Glans*, as if it had been slit longitudinally: It has two small blue Veins marked o:o: and a large Prepuce inverted at H.

The *Scrotum* and *Testes* were and continue in a good Condition; the *Scrotum* KK is corrugated very close to the End of two Prominencies marked E, E; the *Raphe*, I, appears in its Middle with Wrinkles on each Side; the *Testes*, F, F, ly under the Prominencies, they can be moved from the Place they are seated in, either higher or lower as we please to put them.

The Distance between the *Scrotum* and *Anus* is longer than it should be; and the *Ossa Pubis* are longer and flatter than in other Children.

There is a large Prominency, E, E, on each *Inguen*, under which the *Testes* ly.

The Child is healthy, active and stirring, and is very much affected with his Misfortune; for he frequently cries upon viewing himself, and is very unwilling any other should see these Parts.

The Mother is a very healthy Woman,

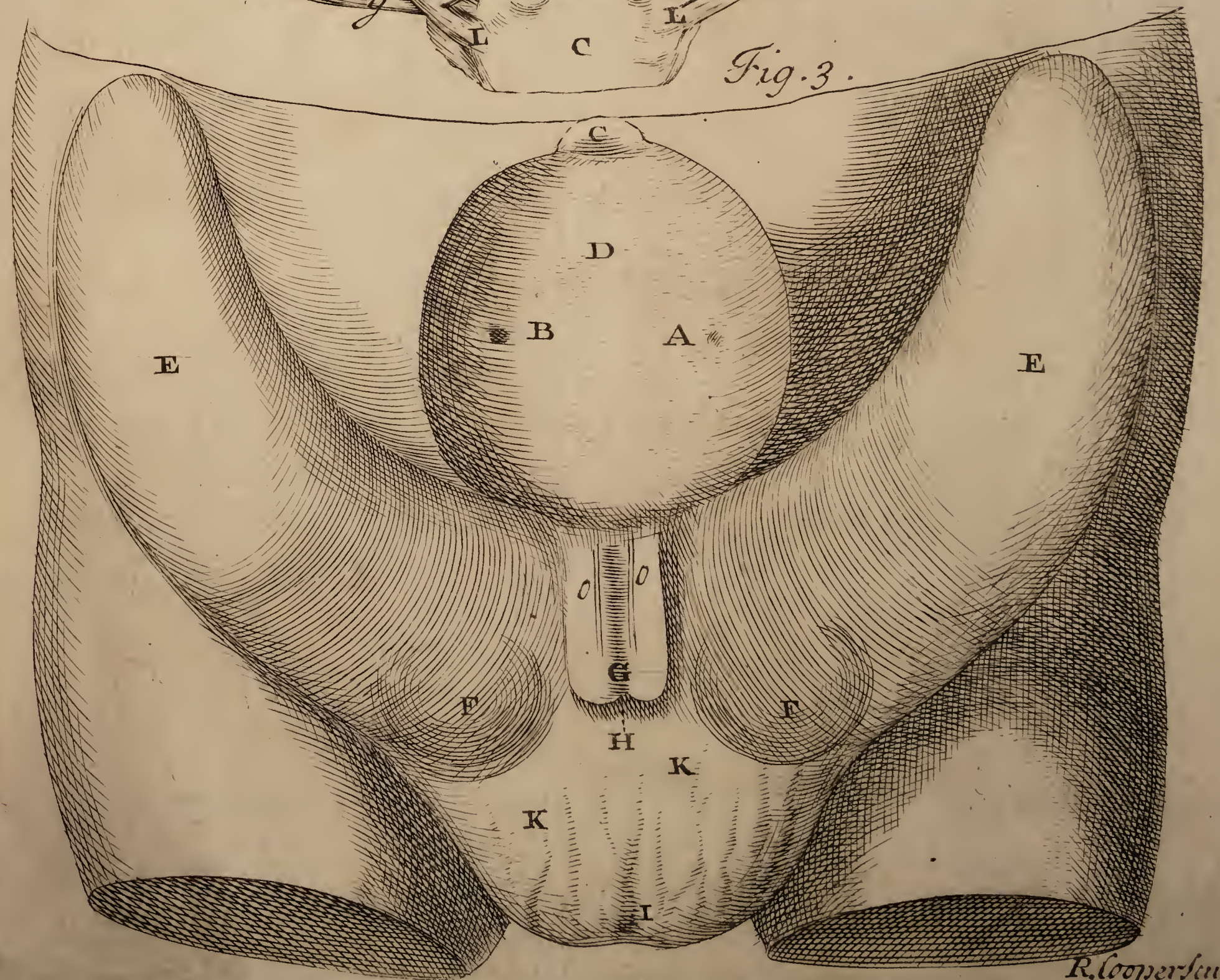
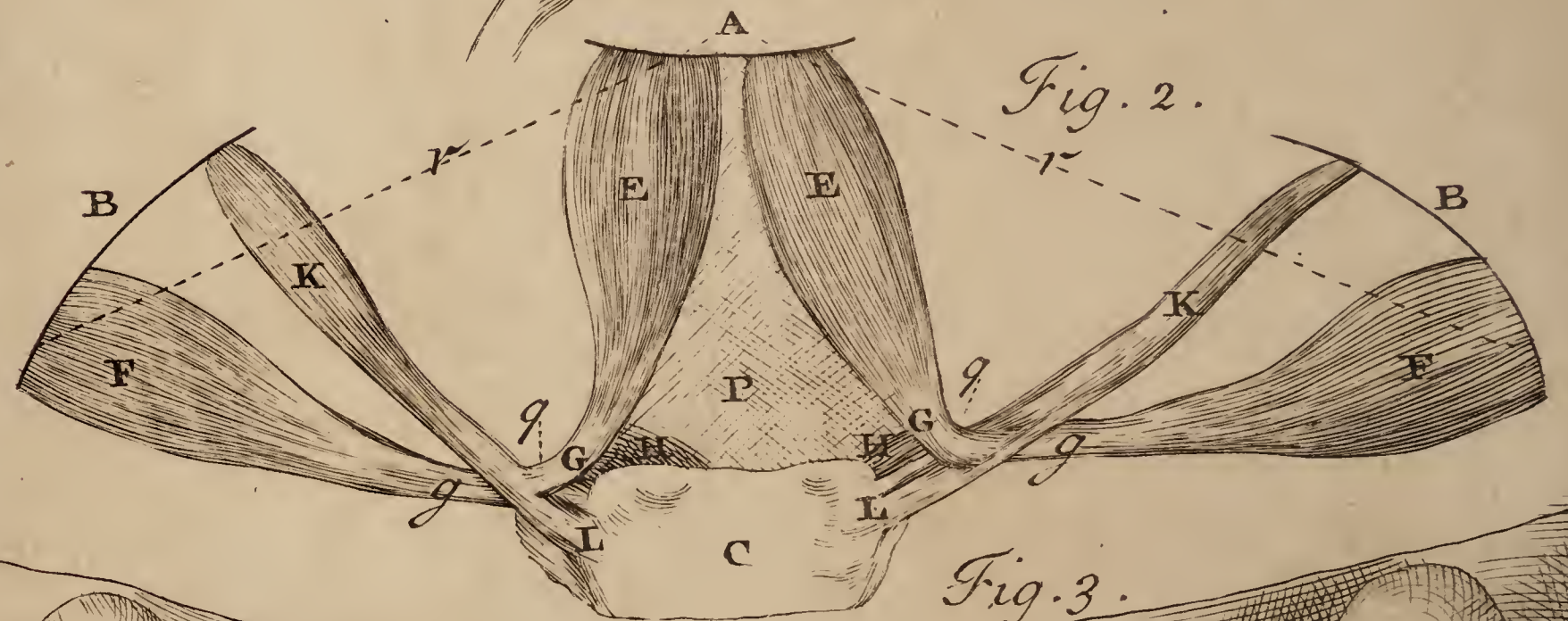
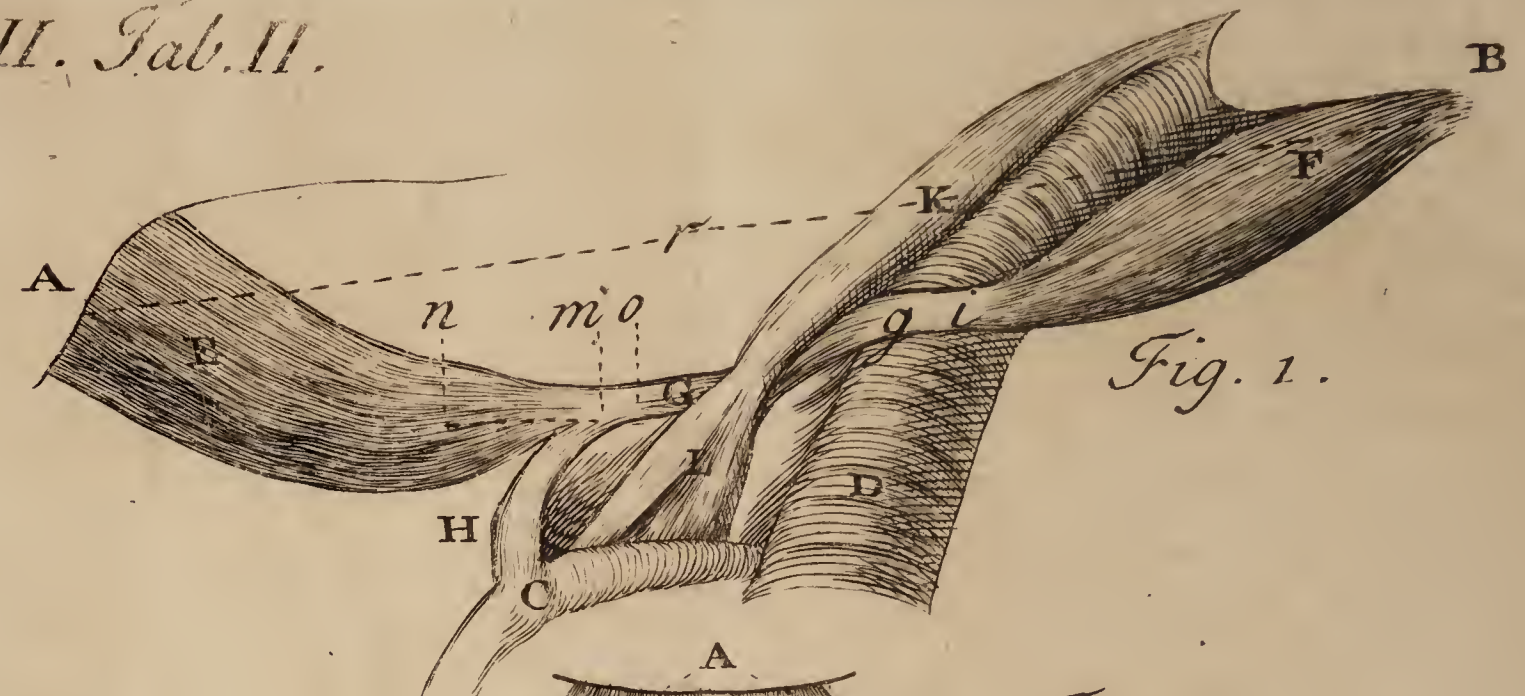
has brought forth another Child every way found and right in all its Members. She tells that in *May*, before she was brought to bed of this her first Child, she was struck in the Belly with a Cow's Horn; she recovered the Hurt in two or three Days, but the Fright remained longer with her, and did terrify her sometimes in her Sleep.

I have twice or thrice thrust down a small Silver Probe at the right *Papilla B*, about an Inch or more, but cannot feel it in the *Perineum*. I have also closed up the *Papilla* two Hours and three Quarters with a small Tent and an astringent Plaister over it, but can discover no Swelling in the *Perineum*, but rather in the Belly. Upon withdrawing the Tent, the Urine squirted a great way; but by the Uneasiness of the Child, and the Anxiety of the Mother, I'm obliged to desist at present from any further Experiments.



XV. *An Essay on the Diseases of the Lacrymal Canals*; by ALEXANDER MONRO Professor of Anatomy in the University of Edinburgh.

THE many Improvements that have been made of late in most chirurgical Ope-



Operations, as they shew how imperfect Surgery was formerly, so they should be an Incitement for endeavouring to improve it still further; which will be found no difficult Task to any who carefully considers the natural Structure and Situation of the Parts that are affected in the several external Diseases; who examines the Changes which these Diseases do, or may make on the Body; who from thence lays down reasonable Intentions of Cure, whereby the Parts may be brought as near to a natural State as possible, or the Functions of such as are disordered or destroyed may be supplied by Art; and lastly, who diligently weighs the Manner, immediate Effects and Consequences of every Step to be taken in executing these Intentions. I shall endeavour to shew, in the following Remarks on the *Fistula lacrymalis*, how far the want of due Attention to these necessary Circumstances is capable of keeping us in Ignorance, and leading us into Error. I made Choice of the *Fistula lacrymalis* for an Example, because it is a common enough Disease that has been often seen and treated by Surgeons, is wrote of in all the Systems of Surgery, and in most Collections of Observations, and is more particularly examined by the professed Oculists; yet, in my Opinion, is

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very

very little understood, and has very defective or faulty Rules laid down for its Cure.

I shall not trouble you with critical Observations on the old Distinction of *Anchylops* and *Ægylops*, or on the Impropriety of reckoning all *Ægylopes* or Ulcers of the internal Canthus of the Eye to be *Fistulæ lacrymales*, or on the Characters of any Ulcer necessary to constitute a *Fistula*; but shall only inform you, that the Disease, I now treat of, is such an Indisposition of the Canals that convey the Tears from the Eye to the Nose, as does not allow the Tears to pass as they ought: If you think the Name of *Fistula lacrymalis* does not agree to this Description, you'll do me a Favour in changing it for a more proper one, or in assigning Names to the different Cases I shall suppose.

The *lacrymal Canals*, whose Diseases are the Subject of this Essay, have been described by several Anatomists, but none of them having these Diseases in View, their Words or Pictures will not probably give your Readers an Idea of these Parts suited to my Purpose; wherefore I shall give a short Description of them, illustrated by the Figures that are sent with this Paper, before I enter upon any Account of their Diseases. (See *Tab. III.*)

The

The two *lacrymal Points*, A, B, (*Fig. 1.*) situated each on a little Prominence near the interior Extremity of the Edge of each *Palpebra*, take in the Tears to be conveyed by two little Ducts of about four tenths of an Inch long, which are continued from the Points inwards and somewhat downwards, (the superior being the longest and most oblique) till they open into the *lacrymal Sac*, D. Between the Points and the Angle where the *Palpebræ* join, the *Caruncula lacrymalis*, C, is placed. The *lacrymal Sac*, D, lies upon the Groove in the anterior half of the *Os unguis*, to which its posterior Part adheres slightly; but this membranous Bag is connected firmly to the Ridge which is raised on the *Os unguis*, at the posterior Part of the Groove, serving at this Place as a proper distinguishing Boundary between the Orbit and exterior Parts; so that the *lacrymal Half* of the *Os unguis* is without the Orbit, while its posterior Half constitutes a Share of the bony Sides of that Cavity. Such another firm Connection of the *lacrymal Sac* to the Bones, is also to be observed at the anterior Part of the Groove, where a small Suture joins the *Os unguis* to the nasal Process of the maxillary Bone.

The *lacrymal Groove* of the *Os unguis*,

D, is about two tenths of an Inch broad in its middle widest Part, and is about half an Inch long from the Top, till it is covered by the maxillary Bone, and a compleat bony Canal is formed for inclosing the whole *lacrymal Duct*, which, after a short Progress, opens into the Nose immediately below the Middle of the superior Edge of the lower *Os spongiosum*, where its Extremity becomes smaller than any other Part of it.

When we view the Side of the Nose after the Bones have been divided by a perpendicular Section, we see the *Ossa spongiosa*, K, L, *Fig. 2.* situated near horizontally, depending by their superior Edge from the other Bones, and removing farther from them as they descend. The anterior Extremity of the *superior Os spongiosum* K, being fixed to the other Bones very near where the upper Part of the *Os unguis* is joined to the frontal Bone; and the superior Edge of the inferior, L, is very little below where the great *lacrymal Duct* begins.

This short Description will, I hope, assist your Readers to understand the several morbid Cases I am now to consider.

If after any Erosion of the Eye-lids, the *lacrymal Points*, or the small Pipes going from them to the *lacrymal Sac*, should be entirely blocked up by their Sides growing together,

together, which may be known by the constant weeping of the affected Eye, after a Disease capable of producing such an Erosion, without any Tumor, but on the contrary with a Depression of the Teguments covering the lacrymal Sac, and by the Points being so obliterated, that one of *Anel's* small Probes cannot be pushed by them into the Sac; in such a Case, I say, the Patient must all his Life bear the Deformity and Uneasiness of a weeping Eye, or some such Operation as the following must be attempted: Let the lacrymal Sac be opened in a slow cautious dissecting Manner; after which push a small round curve Needle with a waxed Thread from one of the Prominencies of the *Palpebræ*, where the *lacrymal Point* naturally is, into the superior Part of the *Sac*; draw out the Needle at the Aperture lately made, and leave the Thread by way of a Seton; do the same at the Part where the other *Punctum lacrymale* was. Soon after the small Inflammation, these Threads may raise, is over, the briny Tears trickling along them will make the Passages callous and fit for supplying the Office of the natural Ducts, when the Threads are to be taken out; and the Aperture in the Sac, which has been kept open by Dossils, and refreshing sometimes with

with the lunar Caustic, will very readily shut up as soon as this manner of dressing is forebore, and that it is only covered with a Pledgit. The Success with which an artificial Passage, formed this Way into the Mouth, has supplied the salivary Duct, (See *Art. XIII. Vol. II.*) may make us judge that the Method just now proposed might also be successful.

When the Fibres of the *lacrymal Sac* are too weak, or the large Duct is obstructed by some concreted Liquors, the *Sac* is gradually stretched by the Tears which regurgitate frequently at the *Puncta lacrymalia*. Some call this Disease a *Dropsy*, others would have it named a *Hernia* of the *lacrymal Sac*. We know it by the Tumor of the *Sac* without Hardness, Discolouring or Pain, which disappears as soon as we press out the Tears at the *Puncta lacrymalia*. While this Disease is recent, these Tears are pure, afterwards some *Pus* appears with them, because of the Excoriation which the *Sac* suffers. Lest there should be any Hazard of mistaking a Tumor or small Abscess in the Teguments, which cover the *lacrymal Sac*, for the Disease of the *Sac* just now described, as I have seen done, allow me to mention, that such Tumor is easily

sily distinguished from the *Hernia* or *Dropsy*, by its not diminishing or not discharging a large Quantity of Tears or *Pus* at the *Puncta lacrymalia* upon Pressure.

The Method of Cure in the Dropsy, is to pass one of *Anel's* Probes from the *Puncta lacrymalia* into the Nose, to remove any grumous Matter that may be lodged in the lacrymal Canals, and then to inject by the *lacrymal Points* mild, detergent, and gently astringent Liquors; such as *Mel Rose* diluted in Lime Water, to which a little Brandy may afterwards be added, or any chalybeat Water, or a little weak Wine, &c. which Injection is to be repeated twice or thrice a Day; and in the Intervals the Cure is assisted by external Compression, made with Compress and Bandage, or the proper compressing Machine, and by Corroborants. We read of several Cures performed in this Manner by Mr. *Anel* and Mr. *Heister*; I have also had Success with it.

It will be necessary here to observe, that the small Duct going from the *superior lacrymal Point*, A, *Fig. 1.* being more oblique than the inferior, it will be more proper for passing the Probe by; and because the Passage from that Point into the Nose is not straight, the Probe must be bended into a small Arch of a large Circle. The
superior

superior Eye-lid being then raised, and its Edge turned a little outwards with the Fingers of one Hand, the Surgeon resting the other Hand on the Patient's Cheek near the exterior *Canthus* of the Eye, introduces the Probe, with its Convexity upwards, into the *Punctum*, and raising his Hand gradually as he pushes the Probe forward, he brings it almost perpendicular to the *lacrymal Sac*, by the Time that the Probe reaches the lower Part of that *Sac*; then he turns the Probe softly, till he brings its Concavity towards the Nose, and pushes it downwards through the great Duct into the Nose. After which he moves it up and down, and to different Sides, to break any concreted Matter lodged in it.

The inferior *Punctum lacrymale*, B, will be fitter for introducing the Pipe of the small Syringe into, and for making the Injections by, because the inferior Eye-lid has not near so much Motion as the superior, and is more easily held with its Edge turned a little outwards; at the same Time that the Surgeon has a better Rest on the Patient's Cheek for the Hand that holds the Syringe, than he can have in making the Injection by the superior *Point*.

If this Method of injecting and compression

sion is not successful, and the internal Part of the *lacrymal Sac* is become spongy and ulcerated, which we judge to be the Case, by the Quantity of *Pus* expressed with the Tears; the *Sac* must be opened by an *Incision*. In doing this I have observed, that notwithstanding the Skin was kept as tense as I could betwixt my Thumb and two Fingers, and an Assistant endeavoured all he could by Pressure on the *Puncta lacrymalia*, to prevent the Tears and *Pus* escaping by these Orifices; I say, notwithstanding these Precautions, I observed that the Pressure of my Knife squeezed out the Liquors contained in the *Sac*, and made it collapse so much, that it could not be opened without a manifest Risk of cutting the posterior Side of the *Sac*, and so laying the Bone bare, which evidently appears necessary to be shunned in the Case I now speak of. To make sure therefore of not falling into this Error, I introduced a small Probe at one of the *Puncta lacrymalia*, and caused an Assistant to raise up the *Sac* with it, while with a gently-crooked sharp-pointed Bistoury, I cut the stretched Teguments in the common Way, till I felt or perceived the naked Probe; when laying aside the Bistoury, and taking a Pair of crooked Scissors, I introduced the Probe-pointed Blade
into

into the *Sac*, and cut it first upwards, and then downwards, till its whole Length was opened.

In making this Opening, the Tendon of the *orbicular* Muscle of the Eye-lid must be cut through; but it is of no Consequence, for the firm Cicatrice afterwards ties that Muscle to the Bones here sufficiently, to prevent any Inconvenience. We are however to take particular Care not to cut so near to the joining of the *Palpebræ*, as to be in any Hazard of dividing them, which might occasion a considerable Deformity; and it will be more convenient to save the *angular* Artery and Vein, than to wound them; because, if they are wounded, the Blood which they pour out, hinders the Operator to see so distinctly what he is doing.

After the *Sac* is fully opened, we can observe in what Condition its interior Surface is, and are at Liberty to free the nasal Duct of any thickned Matter that happens to be in it. Small Dossils armed with some proper Medicines, either of the detergent, drying or strengthening Kind (according to the morbid State of the *Sac*) are laid into the *Sac*, but without being made very hard, or being stuffed strongly in, lest unnecessary Pain and Inflammation should be occasioned. The Lips are then covered with

a small Pledgit, and this is kept on by a semilunar Snip of *adhesive Plaister*. While the Disease is a curing by proper Medicines, the Lips are kept fresh with the Lunar Caustick. When once the *Sac* is made found, the Orifice in the Teguments closes very soon after the Use of the Dossils is forbore, if the Patient is in any thing of a tolerable Habit of Body. I have practised this Method with Success.

When the large *lacrymal Duct* is excoriated, or has fungous Flesh rising from it, which will be known by the acute Pain, or great Insensibility, and by the Difficulty of passing a Probe through it after the *Sac* is opened, and by a View of its superior Part, there is a Necessity of dropping or injecting proper Medicines into it, and of keeping its Sides from becoming contiguous, by introducing some convenient Substance into it. When Medicines are made to pass through it, the Patient must be desired to hold his Head forewards, that the Liquors may run out at his Nose, instead of falling back into his *Fauces*. In my Opinion a small Tent of Lint, secured with a Thread, and armed with Medicines, is preferable to a small Wax *Bougie*, or any thing that is oily, because these keep the
Parts

Parts raw much longer, and don't imbibe suitable Medicines. As soon as the Duct is brought to a right Condition, the Disease is the same as in the preceding Supposition.

Let us now suppose, that the fungous Flesh rising from the Sides of the Duct, has united and blocked up the Passage entirely, which can only be discovered after the *Sac* is open, by the Impossibility of introducing a Probe, or making Liquors pass thro' it, into the Nose, while it feels soft and yielding, without that sort of firm Resistance which a Bone covered with a Membrane makes, and which cannot be described well in Words, but what all Surgeons of any Practice know. In the Case as I have now put it, I think there is still no Necessity of hurting the Bones, in order to make a Passage for the Tears. What I would propose is, to push a small Shoemaker's Awl, or some such Instrument thro' the middle of the *Fungus* into the Nose, and then to keep this artificial Passage open, and to render it callous by a Tent or Seton. In making the Perforation, the Instrument must be held with its Concavity towards the Nose, and it must be thrust through slowly, and with no great Force, the Surgeon changing its Direction a little whenever

ever

ever he touches the Bone with its Point; when the Drops of Blood coming out of the Nose, shew the Instrument to have perforated far enough, it is drawn back, and the Tent or Seton must be immediately passed in the same Way. The Seton is preferable in my Opinion, but requires the Probe by which it is introduced to be of very flexible Silver, and previously brought to a particular Form. You see, *Tab. III. Fig. 3.* a Probe about three Inches long, bended into a Semicircle, only with near half an Inch toward the Point pretty straight; this I have made to pass from the *lacrymal Sac* into the Nose, and brought it out at the Nostrils of several dead Bodies, without using Force, or changing its Form. The small Cord that is brought thro' in the Eye of this Probe, is to remain for some Days, without shifting the Part engaged in the Duct, till it becomes loose by the Suppuration which happens round it; then it may be drawn a little, having besmeared the Part that is to be next introduced with some gentle suppurative Balsam. In a very little Time the Suppuration will waste as much as is sufficient; and then the Detergents and Desiccatives will succeed in bringing the Canal near to the natural State. I need scarce mention the tying of the two Ends of the

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Cord

Cord after each Dressing, to keep them from hanging over the Face, whereby they would be in hazard of being unwarrily pulled; or the Necessity of dressing the *Sac* all the while, as in the former Supposition; or taking out the Cord, and curing all up, after the Duct and Sac are found, they are so obvious.

If the Duct has been blocked up in a Child, and no Cure is attempted, till the Person comes of Age, the Duct may be so obliterated or small, that the Method now proposed cannot be executed, and an artificial Passage must necessarily be made through the Bone: But as this Case can never be certainly discovered till the *Sac* is opened, we ought still to proceed in the cautious Way I formerly mentioned for this Part of the Operation. The Place of the *Os unguis* where this Perforation ought to be made, will easily be determined from the Description I gave of the Parts, and from the Advantage of the Canal for the Tears, being at the most depending Part of the *Sac*. It must not however be attempted to be made where the natural Duct was; for in piercing the Bones in that Place, and with that Direction, the Instrument will more readily pierce into the large *Sinus maxillaris*, than into the

the

the Nose. I imagine any one may easily understand the Place and Direction for making the Perforation right, by observing how the two Pins are placed in *Fig. 1.* and how they come through the *Ossa spongiosa* in *Fig. 2.* at M and N; for the Pin, E, in *Fig. 1.* being thrust perpendicularly thro' the *Os unguis*, about the middle of the *lacrimal Sac*, pierces the anterior Extremity of the superior *Os spongiosum* at M, in *Fig. 2.* and the Pin, F, in *Fig. 1.* thrust very obliquely through the *Os Unguis*, at the lowest Part of the *Sac*, pierces the *Os spongiosum inferius* at N, in *Fig. 2.* F with the perpendicular Direction of E, would answer all Intentions without any Risk.

The Instruments, with which this Perforation has hitherto been ordered to be made, appear to me very faulty. One general Fault to all of them is, their destroying more of the *Os unguis* than is necessary or safe; for wherever the orbital Part of it is diseased, there is great Danger of an Inflammation and Suppuration being brought on the Muscles and Fat within the Orbit, which may be attended with a Train of troublesome dangerous Symptoms, that Art can do little to relieve, because of the Quantity of Fat, in which *Pus* diffuses itself easily, and cannot be restrained by Medi-

cines or Compression in such a Cavity as the Orbit, and in the Neighbourhood of such a sensible moveable necessary Organ as the Eye. The *actual Caутery* gives great Pain, burns the neighbouring Parts, raises Inflammation, and leaves a carious Piece of Bone to exfoliate, which retards the Cure much. The *Directory* or *blunt Stilet*, when pushed through the Bone, fractures it far and near, and often rushes into the Nose so far as to break the *septum narium*. The olive-shap'd blunt Perforative, or the tapering strong *Forceps*, make large Fractures in the Bone, besides opening a Passage large enough to let the Point of one's Finger pass, where one no larger than a Crow-quill is required. In Place of all these then, I would propose always to make use of a Drill, small Perforative of a Trepan, Gimblet, or any such small Instrument that can perforate with little Force and no Fracture. What I have hitherto employed was a Gimblet, which succeeded well.

It is of no great Consequence whether the Bone is made bare before the perforating Instrument is applied, because more Pain cannot be expected in wounding the Membrane of the *lacrymal Sac*, than in piercing the *Membrana Narium*, which
must

must always be done; however, as it is rather easier to the Patient, it will be convenient to make a small longitudinal Incision with a Bistoury in the Membrane, at the Part of the Groove where the Perforation is to be made; and then separating the Lips a little, so much of the Bone is laid bare as to place the Instrument on; but never expose much of the Bone, lest it be rendered carious and an Exfoliation must be waited, which is to be prevented, if possible, in the Case I now speak of, where the Bones are all supposed to be sound.

The whole then of the Operation is to open the *lacrymal Sac* in the manner formerly directed; to make a small Incision in the Membrane of the lower Part of the Groove with the Point of a Bistoury; to separate the Lips of this Incision; to pierce the Bone there slowly, till Drops of Blood falling out at the Nose shew the Membrane of the Nostrils to be also pierced; then withdrawing the Perforative, introduce into this new Passage a Tent secured with a Thread, and dress up as in the Case of the *Sac* being opened. Allow these Dressings to remain till the Suppuration comes on, when they are to be renewed. Whenever the Inflammation is gone, by drying Medicines injected at the new O-

Orifice, or conveyed into it by the Tent, endeavour to harden the Membrane with which the thin Edges of the perforated Bone soon cover. I used *Melrose* and a little Brandy, encreasing gradually the Proportion of this last Medicine. Whenever the Tent can be made to pass this Hole, without giving Pain, leave off the Use of the Tent, and cure up the external Orifice, as soon as it will go together, which is very soon, if its Lips have been gently touched from time to time with the Lunar Caustick. In this way I have cured those who had this Disease from their Infancy, without one bit of Bone exfoliating, or the least weeping in the Eye afterwards, or other Inconvenience, not so much as an observable Scar.

Let us now suppose that the sharp Matter in the *lacrymal Sac* has destroyed its Membrane, and rendred the *Os unguis*, on which it lies, carious; or that the *Caries* having begun in the Bone, the *Ichor* of it has eroded the Membrane. In this Case, if there is a large Passage eroded also thro' the *Membrana narium*, while the Teguments are whole, it may be long before the *lacrymal Canals* can be discovered to be affected; and the Disease will be treated as an *Ozæna*. But if there is no such Passage
into

into the Nose, the Malady may be known by the brown-coloured stinking Ichor diluted with Tears, which may be squeezed out at the *lacrymal Points*, upon pressing the *lacrymal Sac*.

The Method of Cure here will be to open the *lacrymal Sac*, as in the former Cases mentioned, to separate as much of the Bone as is carious, to make a Perforation with the Point of a Lancet or Bistoury, through the *Membrana narium*, and then to complete the Cure, as directed in the preceding Supposition of the Bone being artificially perforated.

The Separation of the carious Bone is ordered to be hastned by the Application of the actual Caustery, Tinctures of Myrrh and Aloes, and of *Euphorbium*: But, in my Opinion, the breaking away with a Pair of *Forceps* all that is carious, will be much more speedy, and is not attended with such Inconveniencies as the other Methods are.

You must have observed, That I have hitherto supposed the Diseases of the *lacrymal Canals* to be attended with no opening of the Teguments made by Erosion, nor with any Maladies of the neighbouring Parts; and I believe you will see there is

no Necessity of insisting at any Length upon them. For when there is an Opening in the Teguments, near the internal *Canthus* of the Eye, we can easily discover whether the lacrymal Canals are affected, by pressing *Pus* out of the *Puncta lacrymalia*, before the Ulcer is cleaned; and after the *Pus* is wiped away, the Tears will run out at the external Orifice, which also gives a better Opportunity of introducing Instruments to discover the State of the diseased Parts.

In the Cure there is nothing different from what has been formerly directed, unless that the Opening into the *Sac* is more easily made, where the external Orifice is large enough to allow the necessary Instruments to be introduced; and when it is too small for this Purpose, we must enlarge it, by putting into it Tents of Sponge made firm and hard, by being soaked in some melted Plaister, and then kept pressed under a Weight, or in a Press till the Plaister hardens; or this Sponge-tent may be prepared, by simply wetting the Sponge in Water, or a diluted Mucilage or Glew, and then rolling Pack-thread firmly round it, and hanging it thus up till it dry.

There is such a great Variety of Diseases

Fig. 1.

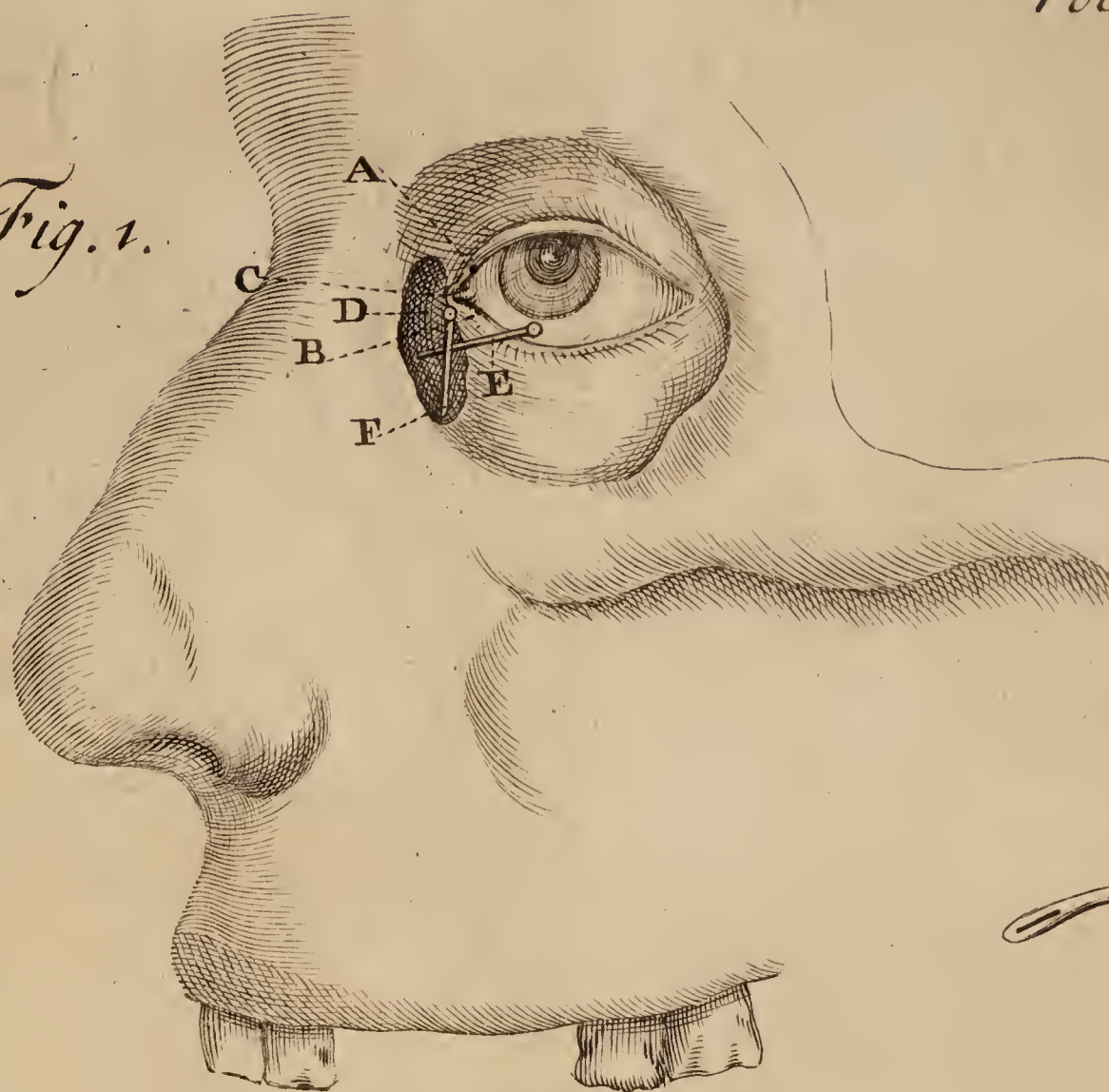
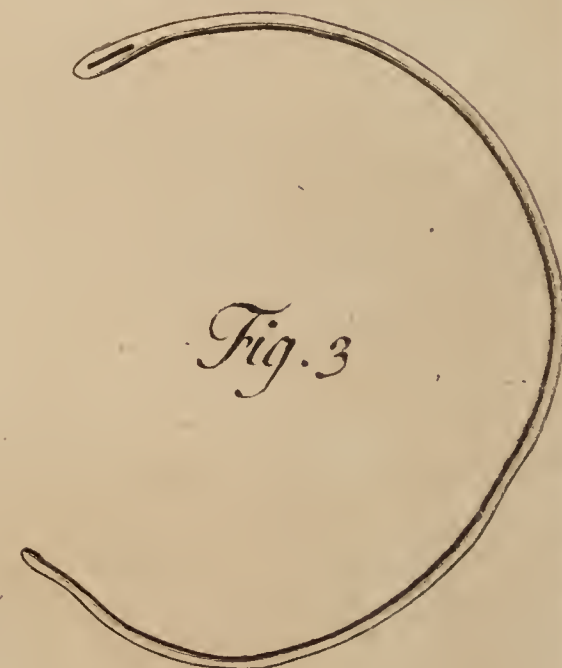
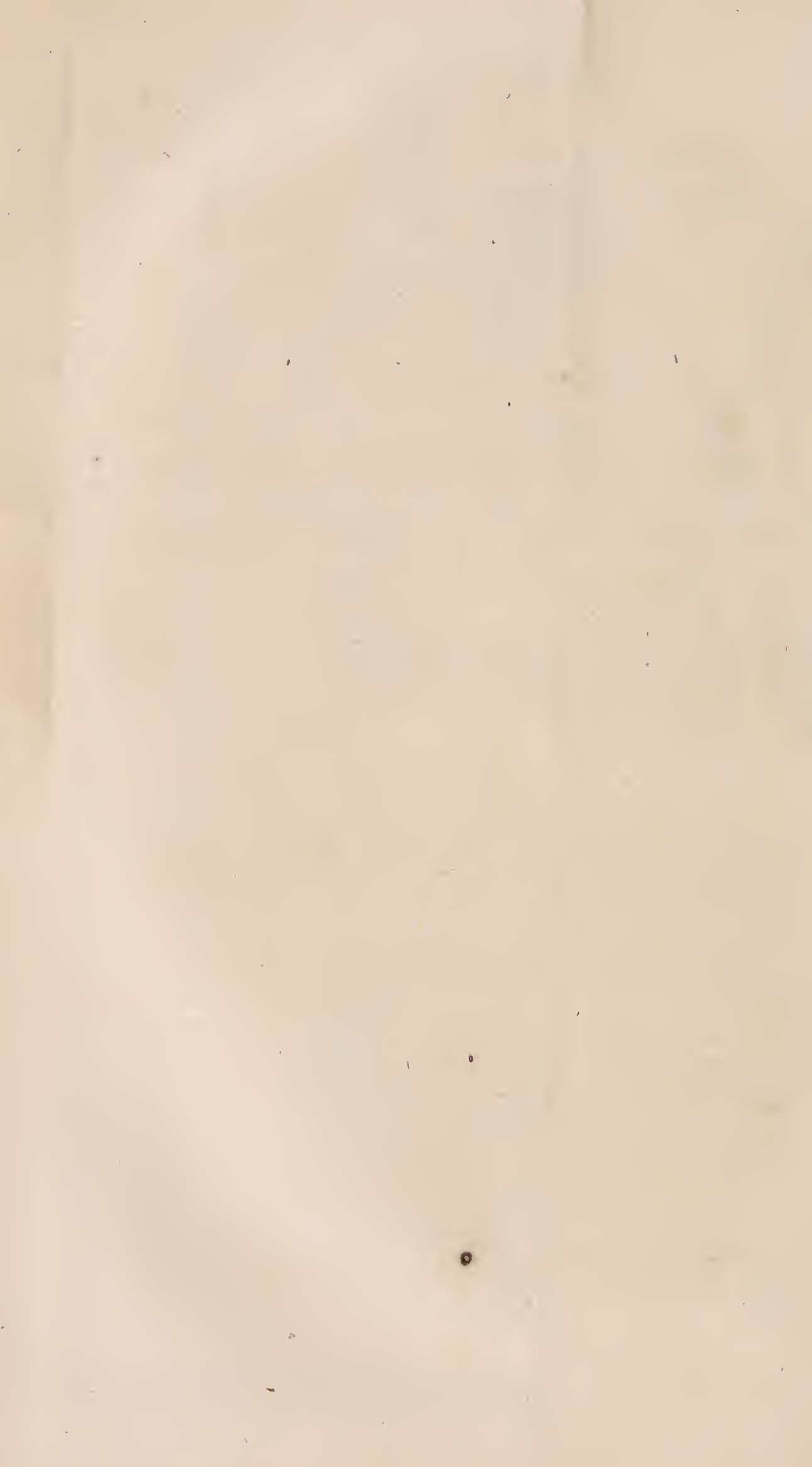


Fig. 2.



Fig. 3.





ses which may accompany these Maladies of the *lacrymal Canals*, whether as Causes, Consequences, or accidental Attendants, that it would be to engage in almost a System of Physick and Surgery to give a Detail of them; and therefore I shall pass them without any further Examination.



XVI. *A Tumor of the Nose unsuccessfully extirpated; by ———*

THE Author of *Art. XXII.* in your first Volume, having had the Benefit of your Promise to conceal the Names of those who send you unsuccessful Cases, I claim the Performance of the same Promise in the Publication of this Paper, if you think it deserves a Place in your Collection.

A Child was born with a small moveable Tumor on its Nose, which increased as the Child grew, otherwise the Child was healthy and strong, having only had a short Fever or two, and passed some Worms, before five Years of Age, when my Advice was first asked concerning that Tumor, which now was so large as to cover all the Nose except the Nostrils, and was so prominent
to

to each Side, that the Eyes were in part covered with it. Towards the Base it was so soft, that by pressing a Finger on each Side, they felt each other, but at the most prominent Part there were several hard round Knots. When I saw it, the Child complained of no Pain, though I was informed that sharp lancinating Pains sometimes struck through the Tumor. I held the Nostrils, while the Child forced its Breath that Way, but saw not the Tumor rise any. I searched into the Nostrils with a Probe, but could neither feel any Excrecence, nor push the Tumor or Teguments outwards. The *Os frontis* was firm, and united in the Middle. From all which I concluded the Bones of the Nose to be compleat, and therefore was of Opinion the Tumor (which would make the Patient very miserable by increasing, and would bring Death at last) might be safely extirpated. Being however taught by *Job à Meekren* (a), and some others, how deceitful Excrecences of the Head, brought to the World with a Child, might possibly be, I would not undertake the Cure, till another Surgeon of more Experience and longer Standing in my Neighbourhood, who just-ly

(a) Observ. cap. 7.

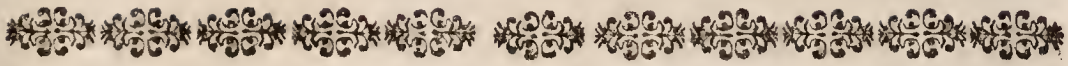
ly has a considerable Character, should examine the Tumor, and assist me in whatever was determined to be done. That Gentleman joining in Opinion with me, I undertook the Extirpation with his Assistance. When I had dissected about half the Base of the Tumor off, I observed the Bones of the Nose to be incomplete, and that the Membrane of the Nose, Part of which I had laid bare, was moved outwards in Expiration, and inwards in Inspiration. Not being certain how far upwards the Bones might be wanting, I dissected all the Tumor off at the lower Part, but left a little of its Base above. Having stopped the Bleeding, I dressed the Wound in the common Way.

When the Tumor was examined, it appeared all of a Substance little firmer than the common Fat under the Skin, except where the Knots were, which were of a schirrous Hardness.

The Child passed the first Night pretty easily. Next Morning the Pulse was a little quick, attended with a Thirst, and a Sickness at the Stomach, which had made the Patient vomit once. An emollient Clyster being injected and Emulsion given for Drink, these Symptoms abated. Towards the Evening the Dressings seemed moister than they commonly are so soon after a Wound.

In

In the Morning of the second Day after the Operation, the Dressings, Child's Hair and Head-clothes, and the Pillow under its Head, were all wet with a watery Liquor, which had a particular Smell that I never felt in any Wound before, and do not know how to describe. The Dressings being taken off, we saw that this Liquor ouzed fast from the bared Membrane of the Nose, though we could not perceive the Orifice by which it escaped. We applied from time to time, *Bol. Armen. Pulv. Helvet. Chalk, Sugar of Lead, white Vitriol, burnt Alum, blue Vitriol, Quick-lime, Brandy, Alcohol. Oil of Turpentine, Spirit of Nitre dulcify'd, plain Spirit of Nitre, Oil of Vitriol, Lunar Caustic, the actual Caustery.* In short, we applied every Thing we could think of that had any Chance for stopping this ouzing of Lymph, but without Success. On the sixth Day our Patient vomited a long round Worm; in some Time after fell into Convulsions, and in an Hour more died.



XVII. *An Account of a Procidencia Uteri;*
by ALEXR. MONRO Professor of Anatomy
in the University of Edinburgh.

—— *Scobie* being seized with a Fever, which continued some Days, in the Month of *August* 1728, when she was not full three Years old, had a considerable Discharge of Blood by the *Vagina* for three Days; after which she seem'd to be in perfect good Health about twenty Days, then complain'd of Pains in her Belly, Loins and Thighs, and had such another Evacuation. The Quantity of Blood voided was judged by her Mother to be as large as what she herself commonly had in her *Menses*. The Child suffered regularly such Returns every three Weeks, or at furthest within the Month, attended with the same Symptoms, without any considerable Loss of Strength, or Decay of her Body, till the Month of *May* 1729. But during the third monthly Evacuation, which was at the End of *September* 1728, her Mother observed a small Swelling rising out from the Orifice of the *Vagina*, which disappeared as soon as the Hæmorrhagy ceased. This Tumor however

ever came out larger at each Period thereafter; but upon the Child's being kept in Bed three or four Days, and the Flux of Blood stopping, always disappeared, till *May* that it came out of a considerable Bulk, and did not return as usual. From this Time there were no more periodical Evacuations of Blood; but instead of these, there was a perpetual dropping of a white Mucus from a Hole in the lower Part of the Tumor, which Mucus was sometimes in so large Quantities, that if a Swath had been applied some Hours about it, to prevent that Liquor from coming away in Drops, as frequently was done, when ever the Swath was taken off, the Mucus was thrown out so abundantly and with such Force, as made those present to imagine it was Urine which the Child passed.

About the End of *July* the Parents having brought the Child to the Hall of the College of Physicians, where Dr. *John Rid-del* and Dr. *William Porterfield* were then attending to give Advice to the Poor; these two Gentlemen having viewed the Child, desired the Parents to carry her to me.

Being informed of the preceding History by the Child's Mother, I examined the Parts, and found a Tumor, G, (See *Tab. IV.*) hanging out at the *Vagina* as big as a Hand-ball,

ball, the Neck of which, F, was about an Inch diameter. At the lowest Part, H, the Tumor was largest, and of a faint leadish Colour: Behind the most prominent Part of it I discovered a Hole of $\frac{1}{4}$ Inch diameter, by which I introduced a Probe, I, some Inches; and then the Probe was resisted, and the Child complained of Pain. From this Hole there was a constant *stillidium* of *Mucus*. Round this Orifice the Tumor felt hard and firm, but a little higher, where it was largest, it was softer, seeming to be composed of a cellular Substance; at this Place Scales had frequently formed and fallen off. The Neck, F, of the Tumor was very smooth, of a shining red Colour, and very solid and hard; I introduced a Probe betwixt this Neck and the Sides of the *Vagina*, two Inches upwards, and turned it all round the Circumference of the Neck. The *Clitoris*, D, *Nymphæ*, B, B, and Orifice of the *Urethra*, E, were natural enough, only the Neck of the Tumor pressing on the *Urethra* occasioned some Difficulty in the Excretion of Urine; and the Urine being diffused over the *Labia magna*, A, A, and other neighbouring Parts, by striking against the large Base of the Tumor, had somewhat excoriated these Parts.

The Child could scarce sit, and straddled when

when she walked, but lying a-bed she was very easy. Her Complexion was pale, and her Body small, otherwise she was healthy. Having consulted with the two Gentlemen who had sent her to me, and several other Physicians having seen her, the Disease was unanimously judged to be a *Procidencia uteri*. Wherefore I attempted to reduce it, but the Tumor was so large and firm, I could not accomplish it. Fomentations and Cataplasms, first of the emollient and discutient Kind were applied, afterwards they were formed entirely of the Attenuants, and lastly Astringents were tried. In the mean Time the Child underwent the general Evacuations as much as her Strength could bear, without the Tumor's yielding in the least, but on the contrary daily increasing; at last she began to turn hectic, and the Tumor to be disposed to gangrene on its outer Surface, which were in vain endeavoured to be prevented by Diet and antiseptick Medicines. I several Times considered of the Amputation; but being sensible of the Body of the *Uterus* being to be cut through, and frightened by the ill Success *Ruyfch* and some others had in this Operation, I had not Courage enough to undertake it. The Child in the mean Time turned weaker, the Tumor gangren'd in its external

ternal Surface, and by the gangren'd Parts falling off, it was reduced to near half its former Bulk. Ten Days after which (7th November) she died.

On opening the *Abdomen* next Day, the Bladder, K, was full of Urine, the left *Ureter*, M, was in a natural State, but the right one, N, was distended by Urine to four Times its natural Diameter, and the Kidney from which it came was larger, softer and paler than the other, but without any Appearance of the *Folliculi* or *Vesicles* sometimes found in morbid Kidneys. The Urine had certainly been retained in the Bladder by the Neck of the preternatural *Procidencia* pressing on the *Urethra*, and the Distension of the right *Ureter* was owing to a steatomatous Body, U, some more than an Inch long, and seven Tenths of an Inch broad, which lay behind the *Ovarium* and *Ligamentum latum*, and reached to the *Cervix* of the Bladder, to which it firmly adhered, and through its exterior Extremity the *Ureter* passed.

There was scarce any thing of the *Uterus* to be seen, till the Bladder was reclined over to one Side, when a small Part of its *Fundus*, O, appeared.

The *Tubæ Fallopiæ*, Q, Q, were near perpendicular to the *Uterus*, and the *Ovaria*,
 U

ria, T, T, were situated contiguous to them.

Having made these Remarks, and carefully observed the Situation in which the several Parts were, I dissected off the *Peritonæum* and its cellular Membrane from the Bones and Muscles composing the Sides of the *Pelvis*, and brought away all the Parts contained in that Cavity with the right Kidney and *Ureter*; and then, that a View of the whole might be had in one Figure, I dissected the left Side of the Bladder away from the *Peritonæum*, and reclined it over to the right; after which, having with a Needle passed Threads through the Skin where the *Mons Veneris* and external or great *Labia pudendorum* are, I gently stretched the Skin of these Parts, and secured it in that Posture by Help of the Threads which were tied to a Probe and two Pins which I had made fast to the Table, in which Posture Mr. *Cooper* delineated it, having his View obliquely from the left Side and from above. The Figure he drew, and afterwards graved, will, I believe, better explain the Situation and Connexion of all the Parts, than any Description, and is the only one I know that gives a distinct Idea of this Disease my Patient laboured under, a true genuine *Pro-*
cidentia



Procidentia Uteri covered with the *Vagina*, and without any Inversion of the Womb.

A. A. The two great *Labia Pudendorum*.

B. B. The *Nymphæ*.

C. *Præputium Clitoridis*.

D. *Glans Clitoridis*.

E. The Orifice of the *Urethra*.

F. The Neck of the *Procidentia* as it came out at the *Vagina*.

G. The left Side of the Tumor, which was much diminished by the falling off of the gangrenous Parts.

H. The right Side which had no Parts cast off.

I. A Probe put into the *Uterus* by its internal Orifice.

K. The Bladder distended with Urine, and reclined over to the right Side.

L. L. The jagged Edges of the *Peritonæum* both on the left Side of the Bladder and of the *Pelvis* where it was cut, to remove the Bladder to aside.

M. The left *Ureter* of the natural Size.

N. The right *Ureter* greatly enlarged with Urine.

O. The *Fundus uteri*.

P. P. The *Ligamenta lata*.

Q. Q. The *Tubæ Fallopiæ*.

U 2

R. The

- R. The *Fimbriae* of the right *Tuba* with its Orifice in View.
- S. The left *Morsus Diaboli* seen on the Side averse to the Orifice.
- T. T. The *Ovaria*.
- U. The Extremity of the *Steatom* appearing from under the right *Ovarium*.
- W. The thick *Tunica cellulosa* at the Side and Back Part of the *Pelvis*.
- X. The *Intestinum rectum*.
- Y. The Probe to which the Thread supporting the *Mons Veneris* was tied.
- Z. Z. The Pins to which the Threads stretching the great *Labia* were fastned.

After the Figure was drawn, I endeavoured to discover by Dissection, how far the inverted *Vagina* or *Uterus* had each been increased in their Bulk to form such a large Tumor; but they were so intimately united, that I could not distinguish the Substance of the one from that of the other; and therefore could not determine their proportional Thickness.



XVIII. *The Description of a Pessary, invented by THOMAS SIMSON M. D. Professor of Medicine in the University of St. Andrew's.*

HERE is no Calamity that afflicts the fair Sex more than the *Procidentia Uteri*, when they labour under it ; for it is accompanied with perpetual Uneasiness through their whole Body : It gives the greatest Hindrance in following out the common Affairs of Life, and frequently ends in ulcerous and cancrous Tumors.

The Causes of this Disease are many, but, which ever takes Place, there is no Hope of a Cure, unless the Part is kept in its natural Situation ; for its Weight, when it hangs unsupported, does more Harm than there can be Service done by any Medicines applied for strengthening and bracing the relaxed Fibres, and therefore the first Step towards a Cure of *Procidentia* has always been to reduce the *Uterus* to its natural Situation, and to keep it there by means of the Instruments named *Pessaries*.

All the *Pessaries* which I have seen described by Authors, or used by Practisers in

Medicine, seem to me defective and inconvenient; for they answer the Design by their Bulk only, and must be thrust violently into the *Vagina*, which not only occasions a great deal of Uneasiness and Pain to the Patient, but a skilful Hand is always required to manage them, which many Women are unwilling to allow. To evite the many Disadvantages attending the Use of the common Pessaries, I contrived the one delivered with this Paper, which I can assure you, after sufficient Experience of it in such Cases, has exactly answered all the Intentions without any Inconvenience.

Fig. 1. of Tab. V. represents the exterior Side of one of the Plates of Tin, of which the Instrument consists.

A is the Body of it, the Sides of which, B, B, C, have Holes made in them for sewing a Piece of oiled Leather on it.

D, A narrow Neck in the Form of half a Hinge going out from the large Plate.

E, A round Plate full of Holes, for sewing upon it a Hemisphere of Cork boiled in Oil.

Fig. 2. shews the Form of the other Plate with its interior Side exposed to View, and with the Leather and Hemisphere of Cork sowed to it.

A, The Plate at the Sides of which, B, B, C,

B, C, the Edges appear turned in, with the Threads which secure the Leather on its Outside crossing over them.

D, A Spring of japanned Steel, which is fastned to the Plate at E, but stands out from it at the other Extremity.

F, The convex Side of a Hemisphere of Cork, sowed to such a Plate as E represents in *Fig. 1.*

Fig. 3. is the Figure of the Instrument mounted.

A, B, The two large Plates.

C, The Spring keeping them at a Distance.

D, One of the small round Plates with the Threads, by which the Hemisphere of Cork is fastned to it.

E, E, The two Hemispheres of Cork.

F, Waxed Threads made to cross from one Hemisphere of Cork to the other, and left of such a Length as to allow the Spring full Play in separating the Plates and Corks.

G, G, Two Skains of waxed Thread passed through the Ends of each Plate, and secured from being drawn out by the Knots at their Extremities.

Having seen D, the half of a Hinge in *Fig. 1.* one can easily imagine what could not be seen in this Picture, *viz.* such ano-

ther applied to the Side of it, when these Necks of the two Plates are made to cross, and that a small *Axis* being put through them, they move easily.

When this Instrument is to be introduced, the two Plates are pressed close together, and the Sphere of Cork is put as high up into the *Vagina* as is convenient, taking care to have the flat Sides of the Plates towards the right and left of the *Vagina*. When ever the Fingers pressing the Plates are removed, the Spring pushes the Plates and Hemispheres away from each other, to press only on the Sides of the *Vagina*, without any Danger of straitning the *Urethra* or *Rectum*. The cross Threads now extended between the Hemispheres, hinder the *Uterus* or *Plicæ* of the *Vagina* to fall down between the Corks, so as to be in Danger of being bruised, when the Sides of the Instrument are again pressed together, in order to take it out, and at the same time Liquors will pass freely. The Corks and Plates covered with Leather when pressed against the *Vagina* by a Spring, which needs not be very strong, cannot bruise its Coats much; and their being oiled preserves them from corrupting soon, as the Metal of the Plates and japanning of the Spring prevent any bad Consequence from Rust.

When

When this Instrument is to be taken out, the Plates are pressed together; or if it has been wholly lodged within the *Vagina*, it is brought away by drawing the Skains of Thread. And the Patient can with little or no Trouble, introduce or remove this Instrument at Pleasure.



XIX. *An Account of the Sides of the Os Uteri being grown together in a Woman with Child; by the same.*

A Woman, forty Years of Age, observably narrow between the *Ossa pubis* and the *Os sacrum*, had been four Days in severe Labour of her first Child, when I was called to assist her: The Child appearing to have been dead for some time, I opened its Head, and extracted it, but with great Difficulty, its Shoulders and Haunches being too large to pass in the straitned Passage between the Bones. During some Days after her Delivery, she passed a great many small rugged Stones by the *Urethra*, and at length, after her Urine had been stopped some Time, her Husband drew out of the *Urethra* a large Piece of thick membranous Substance, three Inches in length, and

in

in some Parts two Inches broad. One Side of it was covered with a Crust of small sharp Stones, the other Side was inflamed and bloody; which made me judge it to be part of the Coats of the Bladder separated; and I was confirmed in this Opinion, by introducing a Catheter into the Bladder; for when ever it touched certain Parts of the Sides of the Bladder, Blood came with the Urine. The Patient continued a long Time with a plentiful Suppuration about the *Pu-
denda*, but we did not suspect that the *Pus* came from the internal Parts, but only from the exterior, which had been somewhat lacerated.

About three Months after her Delivery she fell again with Child, and took her Pains after the ordinary Period. She continued two Days in hard Labour before I saw her. The Midwife then informed me, that the inner Orifice had yielded nothing; I left her half a Day, and Things remaining in the same Way at my Return, I examined her Condition, and found that the *Os Tincæ* had not only not yielded, but that the Sides of it were grown together, without any Vestige of a Passage; whereupon I asked the Assistance of another Physician, and Dr. *Haddow* being called, was, as well as the Midwife, sensible of the Case.
being

being such as I judged it to be. Wherefore we agreed to make an Incision into the *Os uteri*, but were first obliged to dilate the *Vagina* sufficiently, that we might operate more securely. We had no *speculum matricis*, and therefore behoved to supply it by some other Instruments. We tried to make the Dilatation with a Pair of long broad-bladed *Forceps*, but they neither had Strength to dilate sufficiently, nor did they keep the *Vagina* equally open. After this we caused two Pieces of Wood, each three Inches long, and two and a half broad, to be made concave on one Side, and convex on the other, and of no more Thickness than we thought would be sufficient to bear a strong enough Pressure by the necessary Dilatation. When these were finely polished, and besmeared with Grease, I introduced them into the *Vagina*, with the concave Faces towards each other, then sliding in the Legs of a *Speculum oris* between them, and turning its Screw, I separated the Pieces of Wood so far as we could see distinctly the Cicatrice of the grown-together Parts, and could have easy Access to divide them, which I did by an Incision at least half an Inch deep, before I pierced through the Substance of this Part of the Womb; then immediately introducing my
Finger

Finger at this Wound, I touched the Head of the Child, and felt the whole Circumference of the Passage hard like a Cartilage, which yielded nothing to several Throws she had after the Incision: So that I was obliged to guide a narrow-bladed Scalpel with my Finger, to make several Incisions into this cartilaginous Ring. In doing this, there was not the least Appearance of Blood, and the Patient had no Trouble, except what the Dilatation of the *Vagina* gave her. The Labour continuing, the Passage dilated a little, but not so much as to give any Hopes of its allowing the Child's Head to pass, notwithstanding the Bones of the *Cranium* were overloped; and therefore I was obliged to bring away this Child as I had done the former. In this Birth there was no Liquid with the Child, nor did any Blood follow it; it was quite supple, and had a white chalky Crust over its whole Body; so that we were convinced it had been dead some time.

The Want of Waters was some Surprise, till I recollected, that in the time of Labour she told us they were passing, at which Time I had the Curiosity to make a strict Observation, and found that what she called the Waters, passed by the *Urethra*, which opened externally by three different

Ori-

Orifices: This with her having lost such a Portion of the Bladder formerly, and her being subject to the Gravel, gave me Ground to think there was some Communication between these Passages and the Cavity of the Womb, above the *Os Tincæ*, which had allowed the Waters to be evacuated. I was the more inclined to entertain this Supposition, because frequent Instances have been observed of Stones making their Way through the neighbouring Parts, as happened lately to a Boy in this Neighbourhood, who passed a very large Stone, which had lodged long in the Bladder, by the *Anus*, by which the Urine had its Course for some Time after.

My Patient immediately after being put to Bed, was seized with a Pleuritick Pain, very high Fever, and difficult Breathing, which coming on so soon after her being fatigued several Days with hard Labour, during which she slept none, but drank much of every thing in the Way, appeared to me rather the Cause of her Death in twenty four Hours after, than any Consequence of the Incisions I had made; for she never complained of Uneasiness in the Parts I had cut, nor had any *Hæmorrhagy*. Notwithstanding all the Solicitations I could use with her Relations, I could not prevail with

with them to allow me to open her Body.



XX. *The Description of a Forceps for extracting Children by the Head, when lodged low in the Pelvis of the Mother; by Mr. ALEXANDER BUTTER Surgeon in Edinburgh.*

THE *Forceps* for taking hold of a Child's Head, when it is fallen so far down among the Bones of the *Pelvis*, that it cannot be pushed back again into the *Uterus*, to be extracted by the Feet, and when it seems to make no Advances to the Birth by the Throws of the Mother, is scarce known in this Country, though Mr. *Chapman* tells us, it was long made use of by Dr. *Chamberlane*, who kept the Form of it a Secret, as Mr. *Chapman* also does. I believed therefore that a Sight of such an Instrument which I had from Mr. *Dusè*, who practises Midwifery at *Paris*, and who believes it to be his own Invention, would not be unacceptable to you, and the Publication of a Picture of it may be of Use to some of your Readers.

Tab. V. Fig. 4. represents this Instrument

ment seen obliquely, of one third of its real Dimensions.

A, Is the Extremities of the Blades made more concave in the Middle than is necessary to fit them to the Surface of the convex Head of the Child, in order, as Mr. *Dusè* said, to hinder them to compress the temporal Arteries.

B, Is the convex Side of the one Blade.

C, The concave Surface of the other.

D, The Hinge where the two Blades cross.

E, A large flat Button of a Screw, which serves as an *Axis* to the Hinge, and can be taken out at Pleasure.

F, A second Hinge, by which the Blades can be joined when the Child is higher up than can be conveniently reached by the Instrument, when the other Hinge is employed.

G, G, The Handles.

When this Instrument is to be used, the *Axis* of the Hinge is to be taken out, and each Blade, being directed by one Hand in the *Vagina*, is to be introduced separately along the Side of the *Vagina*, and betwixt it and the Side of the Child's Head, as far as immediately above the Ears, then the two Blades of the Instrument being crossed, the *Axis* is put into the Hinge, which the
Ope-

Operator finds most convenient to employ, after which the Child's Head is to be taken firm hold of, and the Operator pulling by the Handles, extracts the Child.

I think Mr. *Chapman* is in the right to desire the *Axis* not to be put in, for it is very troublesome to take out and put in again, when any of the Blades quit their Hold, and the Instrument can easily be managed without it, in extracting the Child in the Manner mentioned; and in several Cases where it may be requisite to dilate the lowest Part of the Passage at the same Time that the Extraction is making, the Blades of the *Forceps* require to be separated, and are not to be crossed or moved upon a Hinge.

You'll easily see, that often when the Head of a Child is a little too far foreward on the *Ossa Pubis*, or turned too far backwards, that one Blade only of this *Forceps* can be employed to bring it to a right Situation, and to assist the Birth.

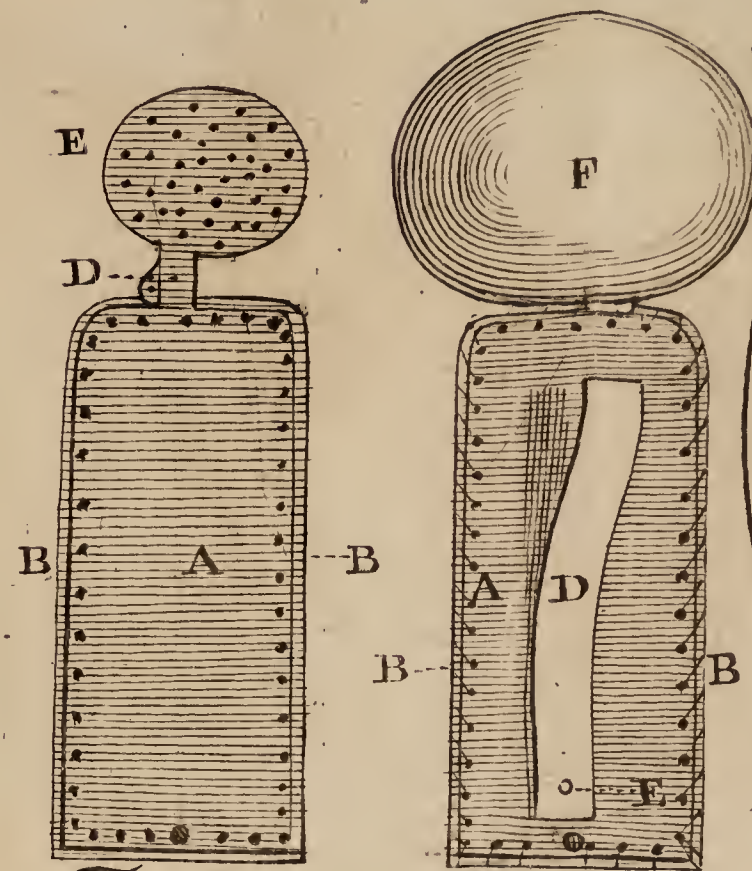


Fig. 1.

Fig. 2.

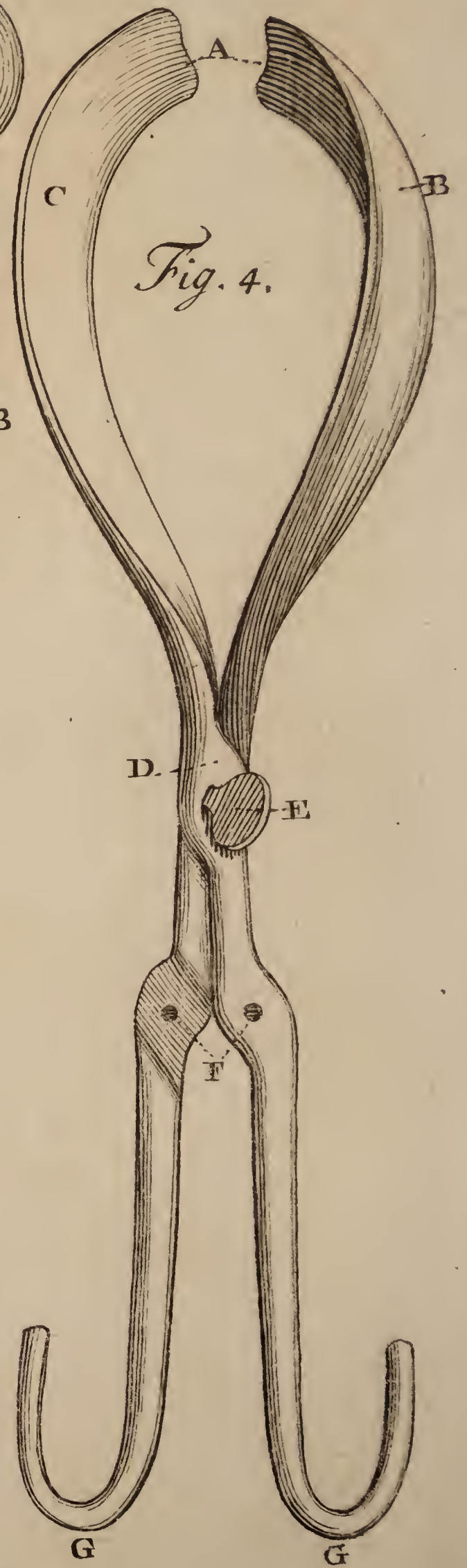


Fig. 4.

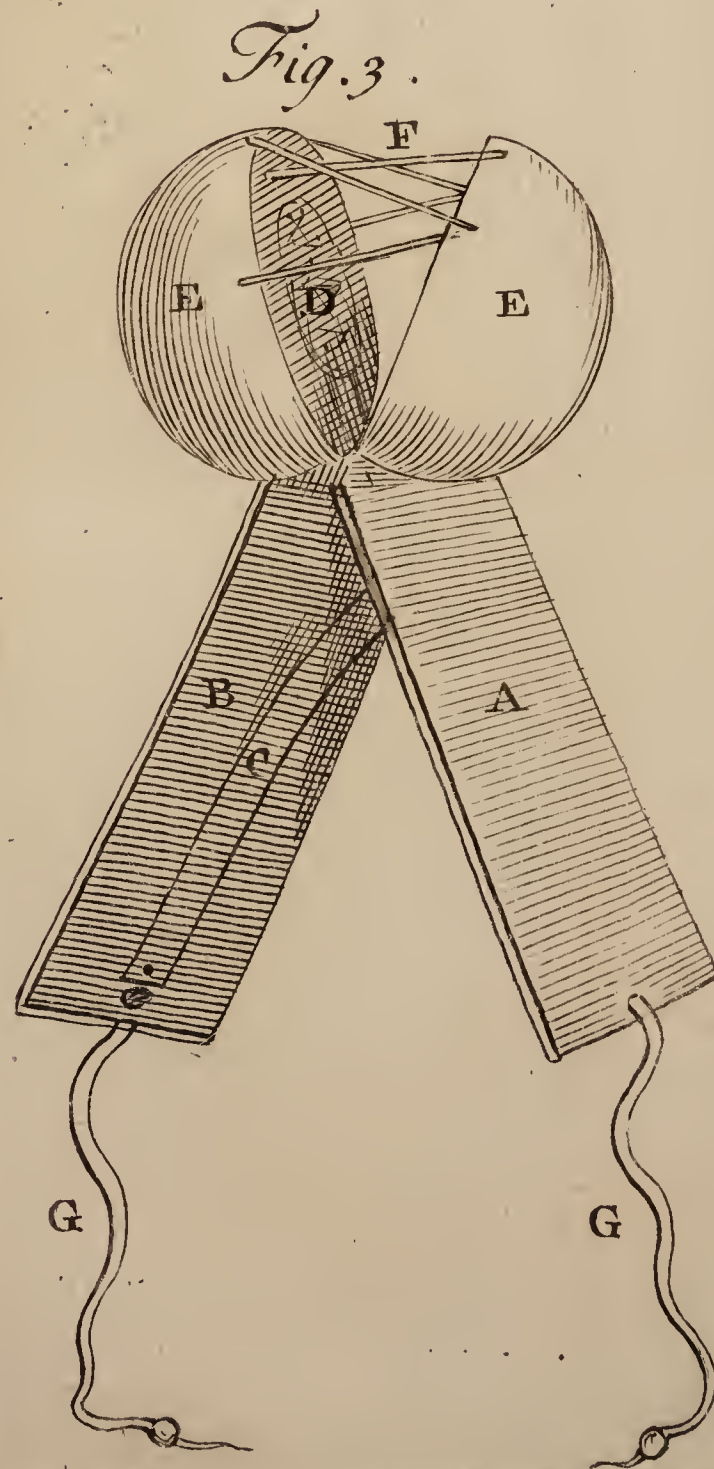
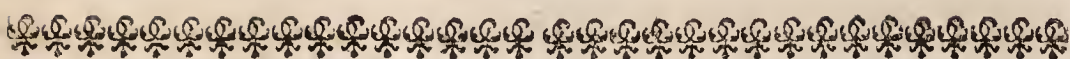


Fig. 3.

R. Cooper fecit.



XXI. *An Account of a malignant Lues Venerea communicated by Suction, in the City of Cork 1728; by EDWARD BARRY, M. D. F. R. S.*

THE *Venereal Disease* in the common Way of Infection has been fatal to many. In this View it demands as much Attention as any Disorder. But if an Accident of this Nature which I now transmit to you, is not guarded against, it may become a more general Misfortune, and to such who least deserve it.

A Woman in this City, who was commonly employed to draw the Breasts of Lying-in Women, had probably in the Course of her Business received the Infection in her Mouth; which she either did not suspect, or concealed, till she had communicated the Poison to several Persons of Distinction.

I think this Infection was still more remarkable for its Malignity, and the quick Progress of the Symptoms, than for the uncommon Manner of its being received. As I had an Opportunity of seeing most of the unhappy Persons who were thus affected, I thought that a faithful Account of its Appearance, and the Method of Cure, which

I found successful, might not be unworthy of a Place in your Essays.

The *Nipple* first became lightly inflamed, which soon produced an Excoriation, with a Discharge of a thin Liquor, from thence red spreading Pustules were dispersed round it, and gradually spread over the *Breast*, and where the Poison remained uncorrected, produced Ulcers. The *Pudenda* soon after became inflamed, with a violent Itching, which terminated in *Chancres*, that were attended with only a small Discharge; and in a short Time after Pustules were spread over the whole Body. It finished this Course, with all these Symptoms, in most Persons in the Space of three Months.

This Disorder made a quick and dangerous Progress in such who first received it; they not being apt to suspect an Infection of this Nature in their Circumstances. The Husbands of several had *Chancres*, which quickly communicated the Poison, and produced Ulcers in the Mouth, and red spreading Pustules on the Body: But such of them escap'd who had timely Notice of the Nature of the Disease, before the *Pudenda* were affected. Some Infants received it from their Mothers, and to the greatest Part of them it was fatal.

When I first mentioned my Opinion of
this

this Disorder to the Midwife of a Person whom I visited, she said the Woman who drew her Breasts was a few Days before, on such a Suspicion, examined, at the Request of a Lady of Distinction, before she would make Use of her; and was declared free from any such Distemper; by which means that Lady was unhappily deceived, and was one of the last who received the Infection. I ordered the Woman to be sent to me, and observed a small Ulcer at the Root of her Tongue, and a large recent Cicatrice on the inward Part of the under Lip. She obstinately deny'd that she ever had any Sore there, but was so much terrify'd, when I told her she would certainly rot away, that she beg'd I would not suffer her to perish, if I suspected so much Danger. While she was in a Salivation, she owned to me and Mr. *Osborne*, an eminent Surgeon in this Place, that she had an Ulcer where the Cicatrice remained, which she cured by two or three Doses of Physick, and a Gargle made of *Woodbine*, and some other Ingredients, and said she concealed it, because she imputed it only to Cold, and was afraid, if known, it might for ever destroy her Business and Character.

This Woman who communicated this Infection to so many, had no Eruptions on

her Body ; and by what I could find, the Infection never made any Progress beyond the Mouth. May not this be accounted for from the particular Way of Life, which she followed, the Humours being discharged by an almost constant *Salivation*, and the Parts deterg'd and cleansed by a Gargle of Breast-milk?

Some Women whose Breasts were drawn by her, had never any Marks of Infection; but by what I could find, the few who escaped were such whom she attended after the large Ulcer on her Lip was healed; for while that continued, the Nipple was received into a Bed of Corruption. But the Case of a Lady was very remarkable, whose Breasts were drawn twice a Day by her, when she communicated the Infection to all others who came in her Way. A violent confluent Small-pox seized this Lady immediately afterwards; and she never had any Marks of Infection.

The Activity of this Poison was so great, that I immediately directed a Mercurial Salivation to even such as were but lately and lightly affected, and ordered it to be brought on by repeated Unctions, in a small Quantity, with a few Grains of *Calomel* internally, and continued the Salivation five or six Weeks.

I have often observed, That where the Salivation easily rises on the Use of a small Quantity of *Mercury*, the Cure is uncertain, and the Symptoms often return: And that the same Inconveniencies often attends a large Salivation accompanied with a great Inflammation, from which many other dangerous Symptoms also flow.

The first of these is more frequently the Case of Women, and such whose Fluids are naturally *dissolved*, and whose Vessels are *relaxed* and *tender*. The other attends Persons of a reverse Constitution. In the former, *Mercury* passes off too quickly through the larger Vessels, without penetrating into the smaller Canals, where the Seat of the Disorder most frequently lies. In the other the great *Viscidities* of the Humours opposes their *Dissolution*, which must be always previous to a free and effectual Salivation; and is absolutely necessary to disengage the Infection from them; so, that it may easily, by a proper Determination, be discharged from the Body: For whenever the Animal Fluids are heated beyond their natural Degree, they immediately become *viscid*; and all violent Inflammations being attended with this Effect, must therefore *counteract* the Operation of *Mercury*. Previous warm Bathing, gentle

Evacuations, if there is a Plenitude in the Vessels, and a diluting Regimen are necessary to prevent these Evils; and after such Preparation, a less Quantity of the Medicine will produce the desired Effect, with more Ease and Efficacy.

In the lax Habit neither is bathing, nor much diluting necessary, till the Salivation appears; but the Medicine must be repeated at a proper Distance, and in a small Quantity to answer this End; though in some Cases of this Nature, it may with more Success be determined to the Surface of the Body, and made *Sudorific*.

The venereal Disorder returned to some after a regular Salivation, but was entirely removed by the following Method, which I made use of to all who had this Infection in a violent Degree.

I ordered a Machine to be made of Oak, the Cavity of which was four Feet long, and sixteen Inches deep, that a Person might sit in it with his Legs extended; a Cover moving in a Groove was so adapted, that it closed every Part round the Body. When this Machine was to be used, it was filled to about the Height of eight Inches, with a strong Bath of Herbs, with *Sal Gem.* dissolved in it. — The Process was as follows.

I directed them to take in the Morning
and

and Afternoon, in divided Draughts, a Quart of the following Decoction.

R. Rad. opt. Bardan, Sarsaparil. Chinæ Glycyrrhiz an. Unc. ii. cum Aq. Decoct. Spatio sem. horæ. adde ligni rasi Santal. rubri, Sassafras an. Unc. ii. ebulliant iterum parum, dein decoct. lib. viii. exhibe.

In the Evening, about an Hour after they had taken the Decoction, they went into the Bath, as hot as they could well bear it; the lower Part of their Body being naked, the rest, and especially the Head, being well guarded from Cold. The Steam, which had no other Passage but where the Opening was allowed for the Body, and the Heat of the Bath, in a few Minutes, threw them into a very profuse Sweat. They seldom remained in the Bath above a half Hour; when they came out of it they were well rubb'd near a large Fire, dry Linen was put on, and they went into a warm Bed, where they continued sweating two Hours: During this Time they drank very plentifully of three Parts Water, and one of Milk warm'd; their Linen was again changed; they sat up for two Hours, and eat a light Supper of Bisquet, with Broth or Sack-whey. At Dinner I allowed them any of the white Meats, with Sack and Water for Drink.

When they had bath'd in this manner five or six Times, I ordered a strong Decoction of *Guaicum* to be used instead of the former, and a few Grains of *Calomel* to be taken an Hour before they entred the Bath; and in some Cases I have directed two Grains of *Turbith Mineral* to be mixt with the *Calomel*; which, though continued for a considerable Time, seldom affected the Glands of the Mouth, being determined with such Force to the Surface of the Body. And, if the Expression may be allowed, *Mercury* thus managed, produces a Salivation through the Pores of the Skin. When the Salivary Glands are in the least affected, the Use of Mercurials is to be omitted, till that Symptom disappears.

I have sometimes observed, that the Mercurial, taken going to Rest the Night preceding the Use of the Bath, is less liable to affect the Stomach, than when taken an Hour before bathing.

I ordered the Bath three Times in a Week; in some Cases repeated it five or six Times successively every Day, and gradually remitted the Use of it.

The Patients were seldom faint with Sweating, a large Supply of Milk and Water, thin Gruel, and sometimes Sack-whey, preventing this Inconvenience. During the whole

whole Course they had a very good Appetite, and more than usual Chearfulness of Spirits. I have known some in desperate venereal Disorders, reduced by former Methods, acquire a good Complexion and Strength in this Course; and though I have used it in many advanced and dangerous Cases, I never met with one unhappy Accident attending it, or with any Instance where it failed.

I have of late given *Mercurius præcipitatus per se* in some Cases, instead of the former Preparations, as being less liable to affect the *salivary Glands* than any other Preparation of *Mercury*. I have frequently directed a Grain and a half of it twenty Nights following, in a common unguarded Way, without observing that it affected the Glands, or produced any remarkable sensible Evacuation: But lately the same Quantity, taken seven Nights successively, raised an unexpected and violent Salivation in a Patient of mine. This, however, has given me a greater Opinion of the Efficacy of this Medicine.



XXII. *A remarkable Hydrocephalum; by*
Mr. JAMES MOWAT Surgeon at Lang-
holm.

A Child of a Year old is rather less and smaller than she was a Month after she was born, having so little Flesh on her Bones, that she is almost a very Skeleton. She has no colliquative Stools to keep her from growing, but is only dull and lethargick. She has two Teeth in the Under-jaw, and two appearing in the Upper. When she was a Month old, her Head began to swell, and continues yet daily to encrease; it is now twenty seven Inches and a half in Circumference; from the Point of the Nose (which is very much depressed in the middle) to the Nap of her Neck, twenty one Inches and a Quarter; from the one Ear to the other, I think it is about eighteen Inches. The Face above the Eyes is exactly six Inches broad; the Cheeks and Mouth are very small for want of Flesh; the Eyes are large, and she can hide them totally within the Orbit, either above or below. All the Bones of the Face and *Ossa temporum* seem

to be very large, firm and broad, without any Suture, till near the Open of the Head; but the rest of the Head is like a soft Quagmire, covered all over with a large, dry, yellow Scab. The Veins upon the Face, and where the Skin is free of the Scab, are very large, full and blue; so that they are visible in their minutest Ramifications. The Child takes no Food but the Mother's Milk: She keeps the Head of the Child always lying in a Hollow between two Pillows.

XXIII. *A Hydrocephalum with remarkable Symptoms; by Mr. JOHN PAISLEY Surgeon in Glasgow.*

A Boy betwixt six and seven Years of Age, of a sound Constitution to appearance, and who had been very healthy from his Infancy, was suddenly seized one Morning with a Pain in the left Side of his Head, attended with an unusual Drowsiness and Lassitude, which increased in the Afternoon; his Pulse not very quick, short Cough, loathing all Kinds of Meat and Drink, an Inclination to vomit, with a flushing in his Face at times, other whiles pale and ill-coloured, and Pains in his Belly;

ly; the Gums of his four back Jaw-teeth much swelled, and his Mouth hot.

It being suspected that Worms were the chief Cause of his Disorder, some Worm-powders were given him, Clysters injected, and his Belly rubb'd with the *Unguentum vermifugum*.

The first three Days he continued much the same Way, being always more brisk and lively in the Forenoon, but very dull and heavy in the Afternoon. On the fourth Day he complained more of the Pain in his Head, and being a little more feverish, he was let blood at the Jugular to betwixt four and five Ounces, had a Clyster injected at Night, and next Morning got a Vomit of *Ipecacoanna*, which operated very well: At the second Puke he brought up a pretty large live Worm, five or six Inches long, of the *Teres* Kind; by this he seemed to be somewhat easier, and more lively all that Day.

On the sixth he got some more Doses of Worm-powders, though it was with great Difficulty he could swallow them, having an Aversion to either Meat or Drink, as well as to the Powders; A Vermifuge Plaister was applied to his Belly, and a Clyster injected.

On the seventh his Pulse was rather slower than the natural; and though, as was observed, he used to be more quick and lively
in

in the Forenoon; yet this Morning he was so drowfy and dull, that it was with great Difficulty he was prevailed on to take a purgative Potion: It was much stronger than any he had ever taken, yet had no Operation; wherefore he got a strong purgative Clyster, by which he had only one Stool, being a Discharge of some hardned Fœces covered over with a Kind of Mucus or slimy Stuff, and with them a large Worm like the former, nine Inches long, came away.

On the eighth, he was so dull and sleepy that he could be diverted no manner of way, nor prevailed upon to take any Aliment, and far less Medicine: The purgative Clysters, continued to be injected, never gave him above one Stool. In the Afternoon he seemed lethargick, his Pulse slow and unequal: A Clyster made of the Tops of Wormwood and the lesser *Centaury* boiled in Claret, was injected, and a bitter Infusion in Wine was ordered to be taken by the Mouth; these raised his Pulse a little, and he began to take some *Panado*, or other soft Aliment, which he did in a very quick Manner, staring very broad, and without speaking a Word, but could not be prevailed upon to taste any kind of Drink; and so soon as he had done, immediately fell asleep again.

On

On the ninth he was much as the Day before, only more comatose: A blistering Plaister was applied to his Neck, which rose very well, and discharged a good Quantity of Serum, without in the least rousing him, or making him more sensible, only his Pulse was a little quickned.

On the tenth he was much as the Day before, only his Face was very florid and red, and somewhat swelled; and he frequently put his Hand to the left Side of his Head, breathing a little quicker than usual, with a wheezing and some Difficulty, his Pulse slow and languid: Upon which his Head was shaved, and the Part where he complained the Pain was at first, and to which he often put his Hand when he could not speak, though there was no Appearance externally of any Swelling, was scarified and cupped, and three or four Ounces of Blood drawn away: This eased him as to his Breathing, and removed the Redness and Swelling of his Face, but produced no other visible Effect; *Suppedalia* were applied at Night.

On the eleventh his Pulse was exceeding slow and intermitting, his *Coma* so much increased with Startings, that he could take no Kind of Aliment, and appeared to have no manner of Sense; and thus he continued perfectly

perfectly insensible till next Forenoon, when he died.

All along he had such a Heaviness in his Eye-lids that he could not lift them up with Ease, and they appeared swelled.

Upon opening his Head, so soon as the *Cranium* was removed, I observed a Pro-tuberance or Tumor about the Bigness of a large Hasel-nut, on the *Dura Mater*, under the *parietal* Bone of the left Side, about an Inch and a quarter from the sagittal Suture, and about two Inches from the Lambdoidal, which was the Place the Child had pointed his Pain was: This Tumor had made no apparent Pitting in the Bone; it felt soft, and upon opening it, there issued out a little bloody Serum, and in the Bottom of it I discovered a great Number of little white Bodies like the small Worms in blown Meat, or the Substances squeezed from Persons Noses; they had no appearance of Life, and were contained in a Duplication of the *Dura Mater*; the inferior Side of which at this Part adhered so firmly to the *Pia Mater*, that it was impossible to separate them without lacerating these tender Parts. There were several other smaller ones along the left Side of the *Sinus longitudinalis superior*, besides the common luxuriant Risings of the Brain that are
always

always observed in this Part ; these contained the same Kind of bloody Serum and white Bodies as the large Tumor : Whether they were real Worms, or an Obstruction in the Glands of the *Dura Mater* following some Inflammation in these Parts, I could not determine, but rather incline to the last ; since, wherever they were, there was such a strong Adhesion of the *Dura* and *Pia Mater*, that they could not be separated without lacerating the tender Parts below. All the Veins in the Head were turgid with Blood, as if they had been finely injected, though there was little or none in the other Cavities when opened.

When, in taking out the Brain, I had cut the Optick Nerves, I observed a preternatural Thickness of the *Pia Mater*, and a large Distension of it as with Water ; upon cutting it open, about half an *English* Pint of a yellow-coloured Water issued out. In dissecting the Brain, I found the *Ventricles* had been much distended and enlarged by the Water ; the *Plexus Choroeides* were hard and scirrhous, with a great Number of small *Hydatides* (as I supposed) lying along them in Rows, whose Coats were exceeding tender, and burst upon the least Touch ; they exactly resembled the Lymphaticks

phaticks delineated in the fifth Table of Dr. *Ridley's* Anatomy of the Brain.

I observed little that was remarkable in any of the other *Viscera*, they being all perfectly sound, except the Intestines, which were empty, and in several Places inflamed, with apparent Signs of a beginning Mortification: There were some few of the *Teres* Worms in them that appeared dead, most of the small Intestines being transparent, and in two Places one Part was drawn up considerably into the other, like the Finger of a Glove; as if the peristaltick Motion of the inferior Part had been inverted, while that in the superior Part continued; and so the one thrust into the other: It took a considerable Force to draw the one out of the other, the Intestine being much contracted in this Part, though there was no Sign of any Inflammation in these Parts.

Since this Case was under my Care, I have seen several Children who complained of a Pain in one particular Part of their Head, having a great Drowsiness and Heaviness in their Eye-lids, a Pulse much slower than the natural, no Drought, a great Aversion to Food or Drink, an Inclination to vomit, and other Symptoms, as this Boy had, which made me judge them to labour

under the same Disease ; and the Dissection of two, who were all I was allowed to open, shewed my Opinion to be just, the Parts being found affected in much the Manner above described, only that I could observe in neither of them any thing like the little Tumors mentioned in the former Case ; and in the latter two, all the Vessels of the *Plexus Choroeides* were hard and obstructed, and the *Pia Mater* at the Bottom of the Brain, immediately under the Optick Nerves, was so considerably thickened, as to appear almost like the *Dura Mater*.



XXIV. *An uncommon Angina; by* ALEX^r. MONRO *Professor of Anatomy in the University of Edinburgh, and F. R. S.*

A Man, thirty four Years of Age, subject all his Life to Plethorick Indispositions, especially in the Spring, and to *Catarrhs* when the least exposed to Cold, who had not used any fermented Drink or heating Food for several Years, on account of a slight *Hæmoptoe* that had more than once seized him, and had retrenched some
of

of his ordinary Diet for near two Months; to prevent his vernal *Plethora*; having sat several Hours in a Chamber without a Fire, and with an open Window, while the Weather was very cold and the Air foggy about the Middle of *January* 1732, complained, as soon as he rose from his Seat, of being stiff with Cold and very weary, with Pains in moving all his Muscles, and perpetual yawning: To free himself of the uneasy Coldness, he immediately went home, sat near a Fire and drank Tea, but could not remove the Shiverings and Weariness. Upon going into Bed he was seized with the appearance of an aguish Paroxysm, which had made a regular Course before Morning.

Next Day he was a little feverish, and still complained of Pains through all his Body, and therefore took his usual Cure in slight Maladies of that Kind, *viz.* a laxative Ptizan in which *Tamarinds* and *Senna* had been boiled; which operated gently, and gave him considerable Relief.

The Day following he was almost free of all his former Complaints, but his right *Amygdala* was swelled and painful, for which the Ptizan was repeated.

In the Morning of the fourth Day the *Amygdala* was less and freer of Pain, and, except a little Bitterness in the Mouth, he

had scarce any other Uneasiness. But in the Afternoon the left *Amygdala* became painful on the least Attempt to swallow, his Pulse turned quick, but not very strong: He was let blood at a large Orifice of a big Jugular Vein, to the Quantity of sixteen Ounces; after which his Pulse became very quick, strong and full: On this appearance of *Plethora*, eight Ounces more were taken away, and the Patient then inclined to faint; but in a quarter of an Hour after, his Pulse was very near as strong and quick as ever. The Pain of the left *Amygdala* was so far from being diminished, that it continued increasing, and all the Teeth in the same Side of the lower Jaw, that were otherwise very sound, were also violently and constantly affected, but the Pains were most exquisite when he swallowed. In the mean time he could open his Mouth as wide as ever, and nothing preternatural could be observed in his Fauces, except a small swelling of the right *Amygdala*, and an Erysipelatous Redness of the *Uvula*, *Velum pendulum* and left *Amygdala* without any Tumor. After he went to Bed, the Pains were so racking, especially when he swallowed his Spittle (which he could not possibly prevent doing frequently, whatever Care he took to the contrary) that though he

he is a Man who is tolerably patient under Pain, he made the whole Bed shake with his Tremblings, and large Drops of Sweat appeared on his Skin at each Attempt. About Mid-night he could ly no longer, but putting on his Clothes, he received the Fumes of warm Water into his Mouth; and the Pain remitting somewhat, while he endeavoured to hinder the Occasions of its violent Increase, by leaning his Head forward, opening his Mouth, and so allowing the *Saliva* to run out, he passed the rest of the Night in a drowsy nodding Way.

Next Morning his Deglutition was performed with great Difficulty and Pain, and he was so hoarse he scarce could be understood when he spoke, but had no Difficulty of Respiration, and the Fulness and Strength of his Pulse were less, but its Quickness remained. His Throat had the same appearance as the Night before. The purgative Ptizan was repeated. The Fumes of warm Water were often made Use of, and an emollient Cataplasim was applied externally on the pain'd Parts.

In the Evening the Pain was easier, and the Pulse rather better, but the Hoarseness continued. A blistering Plaister was applied on his Neck and Back, and Emulsion was prepared for his Drink.

The Plaister did its Office well, and the Patient, notwithstanding his Pain in swallowing, drank two Bottles of Emulsion in the Night, which prevented any Strangury till near Noon of the following Day, when the Chamber being overheated, and the Patient thereby put into a Sweat, the Strangury came on violently, of which he was relieved after some Hours, by carrying away the Fire, and injecting an emollient Clyster with Turpentine. The emollient Poultice was in the mean time renewed, and the Fumes of Water were frequently applied, and a mild resolvent Gargarism assisted the Evacuation of Mucus, which began now to be discerned in more than ordinary Quantity in the Fauces. In the Evening the Patient seemed by his Pulse to be pretty free of Fever, and all his troublesome Symptoms were considerably removed.

The blistered Parts discharging plentifully the two succeeding Days, he seem'd to mend apace, but still continued the Poultice, Fumes and Cataplasma.

On the third, which was the ninth of his Disease, finding in the Morning the Pain increased, he took the laxative Ptizan, and plied the topical Medicines; but through the Day the Symptoms gradually increased, till in the Evening his Pain in the left A-

mygdala

mygdala and Teeth was rather more violent than ever; the Hoarseness was worse than formerly, his Pulse was low and quick, he was drowsy, and passed little Urine. No Swelling could be seen on the left pain'd Side, and he breath'd freely. He drank largely of warm Posset made with *Rhenish* Wine, and chewed long Pepper with the Teeth of the affected Side. His Urine soon came in great Plenty; he discharged large Quantities of Mucus at the Mouth, and in two or three Hours was much freer of Pain; his Pulse turn'd slower, and the dozing went off. The Gargarism was renewed with the Addition of some *Aq. Theriac.* and *Sp. Nitr. d.*; and *Theriac. Andromach.* was added to the Cataplasim.

By the Use of these Medicines he was greatly recovered in the two following Days, and nothing remaining the third, except a little bitter Taste, a trifling Swelling in the right *Amygdala*, and a Weakness in the left Side of the *Fauces*: He went abroad to his usual Labour of dissecting in the Forenoon, and prelecting in the Afternoon, which he continued to do for a Week, using a spare Diet and applying the Topicks, in which Time he got quite free of all Uneasiness, except a dull Pain of the left Side of the *Fauces*, especially in yawning; and

he imagined all the Food he swallowed passed only by that Side, where sometimes a little of it stopt, and was with some Trouble pressed back again into the Mouth.

To remove this Weakness, the Patient one Evening gargled his Throat with Claret Wine and a little *Aq. Theriac.* mixed. That Night he was sensible of a straitning in his Breath, and in the Morning when he awaked, he was quite hoarse, breathed with more Difficulty, and, on coughing, his Head and Eye-balls felt as if strongly girded, his Face became very red, and he began to hiss in breathing. All these bad Appearances went greatly off, after breathing in the Fumes of warm Water, and drinking warm Tea. In a few Hours after he swallowed Pills composed of *Mercur. d.* and *Resine of Fallap*, which operated mildly, and lessened all the Causes of Complaint considerably, and a second such Dose taken two Days after, removed all of them entirely, except a little Weakness of the left Side of the Fauces, and an obtuse Pain there in yawning, which remained several Weeks after.

In the History of this Disease I have given a strong Hint who the Patient was, and suspect the common Frailty of enlarging on one's own Misfortunes, may have discovered

vered sufficiently that it is *my own Case* I have related.

What was the particular Seat of this anomalous *Angina*? Will the Uses assigned to the digastric Muscles in *Art. XI, of Vol. I.* be of Use to discover it?



XXV. *An Asthma with uncommon Symptoms; by the same.*

MR. James Ure, whose Business as a Writer, or Solicitor at Law, engaged him frequently in Company and good Fellowship, was sometimes troubled with a Palpitation at his Heart, a trembling in his Hands, and Faintness, being always subject to a Cough, and having generally very little Appetite for Food, with two or three loose Stools a-day. In *October 1730*, the fifty fifth Year of his Age, having caught Cold, a Cough, seized him, with which he brought up a small Quantity of very thick Slime, and complained of a Difficulty of breathing; he lost all Appetite for Food, and his Belly became bound; his Urine was in small Quantity, and he could not feel his own Pulse.

He allowed these Symptoms to continue
eight

eight Days without asking any Advice; but finding them continue, and rather increase, he consulted Dr. *William Porterfield* and me, *October* 20th. Besides the above-mentioned Symptoms, we observed his Difficulty of Breathing increase so much upon lying down, that he was obliged to sleep in a sitting Posture. His Feet and Legs were very oedematous. We could feel no Pulse in the Arteries of his Wrist, Neck, Temples or Ham, but only a sort of Trembling under our Fingers, which we then attributed to some Irregularity in the Distribution of his Arteries, notwithstanding his affirming, that, when in Health, he had a pretty strong Pulse in the very Parts we felt. The Veins of his Arm and Neck were very large, and stretched with Blood. He could take no sort of Food, but had a Thirst, which was not violent, nor was his Tongue dry, or his Skin hot. When the Cough attacked him, he forced very little Pituit up; but his Breathing became exceeding laborious, his Face turned very red or Purple, and he complained of a violent Headach. When he was free of the Cough a little while, he walked, spoke, complained of little, and assured us he was scarce weaker than in Health. To prevent the bad Effects of the Cough, twelve Ounces of Blood were

were immediately let; he bled freely, and did not turn faint. In the Evening a *Terebinthinat* purging Clyster was injected, which purged him gently. He was desired to take any sort of mild Food which his Stomach could receive. *Rhenish* Wine and Water were given for Drink, into which he frequently dropped forty Gutts of the following Mixture, *R. Elixir. Pectoral. Unc. i. Tinctur. Castor. Drach. ii. Sp. Salin. aromat. Drach. iii.* and every two Hours he swallowed two Spoonfuls of the *Oxymel pectoral.* of the *Edinburgh Dispensatory.* At Bed-time he took this *Bolus. R. Sperm. Cet. Scrup. i. Sal. Succin. Gr. v. Conserv. Ros. Scrup. i. Syrup. Alth. q. s. ut ft. bol.*

Next Morning there appeared no Change in his Condition; and he took *P. Hypecacuan. G. xxxv. Oxymel Scillit. Unc. i.* This Emetick operated six Times, without increasing his Headach or Difficulty of Breathing, and brought a good deal of Slime with the Water he drank. He seemed a little relieved after this Vomit, and continued the Use of the Medicines prescribed the Day before. At Night a blistering Plaister was applied to his Neck and Shoulders; he took his Bolus, and had a cooling Emulsion for Drink.

The

The Blister rose well, but the Pain of it made him so unable to move next Morning, that we could not give the Purgative we had determined to order. His Urine was in larger Quantity, with a good Sediment; notwithstanding which, his Legs were rather more swelled, and the other Symptoms continued. His *Bolus* was again given in the Morning; he still drank Water with *Rhenish* Wine; and he was desired to take frequently a Spoonful of the following Mixture, *℞. Aq. Hyssop. Puleg. a. Unc. iii. Cinam. f. v. Raphan. Compt. a. Unc. i. Gum. Ammoniac Drach. ii. Sal. Succin. Drach. sem. Oxymel. scillit. Unc. ii. Syrup. Alth. Unc. i. M.*

He continued much in the same Way all the 22d and 23d, only his Legs and Thighs swelled more; and he began to complain that his Clothes were too tight for his Belly.

In the Morning of the 24th he took this purgative *Bolus*, *℞. Pulv. Rhei elect. Scrup. i. Aquil. alb. Pulv. Fallap. a. gr. v. Syrup. de Rhamn. q. s. ut. ft. Bol. capt. è Syrup. Violar.* This purged him mildly, and the Quantity of his Urine increased considerably, and his Belly and Legs became less swelled, which relieved him somewhat of the *Orthopnea*.

Next Day he began to use a medicated
Wine,

Wine, ℞. *Rad. Irid. Florent. Scill. Acor. ver. Helen. Raphan. rust. a. Unc. sem. Gentian. Drach. ii. Rub. Tinctor. Unc. sem. Cortic. Sambuc. Ebul. a. Unc. sem. Herb. Marub. alb. M. ii. Absinth. rom. Centaur. min. a. M. sem. Bacc. Juniper. Unc. i. sem. Sal. Tartar. Drach. iii. incis. & contus. f. a. M. ut ft. Malia infundend. in vin. Lisbon. lib. vi. Colatur. capt. Unc. ii. mane & horâ 5ta vespertina.* All this Day and the following his Urine passed plentifully, with a large Sediment; the Swellings diminished, and his Cough and Breathing were easier. In the Evening of the 26th, while I sat by him, he surpris'd me with putting his Wrist into my Hand to feel his Pulse, which was full, strong, slow and equal; but two Hours after, I could again feel no more than the very weak trembling I formerly mentioned.

The 27th the purgative *Bolus* was repeated. On the 28th, his Pulse returned, and continued afterwards firm and strong, till he recovered his former Health, which he did in a little Time, by the Use of the medicated Wine, pectoral Mixture, and the Purgative sometimes repeated.

About a Month after, having got the Cold again, his Symptoms began to return with the same State of his Pulse; but upon taking
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the former Emetick, and the Purgative, they went off; and to prevent a second Relapse, he got strengthning chalybeate Medicines, with the stimulating Gums for some Time.

In the Beginning of *January* 1732, he was again attacked with the *Asthma*, and want of Pulse; which were removed with two Doses of the Purgative. After a Cough which continued some Days in the Beginning of *February*; his Pulse could not be felt during twenty four Hours, but it returned after the Operation of a purgative *Bolus*.

Soon after my Patient retired to the Country, where he has continued in very good Health; and being lately in Town, revised this Account of his Case, and allowed me to communicate it to you.



XXVI. *A large Steatom passing with the Oesophagus from the Thorax into the Abdomen; by Mr. JAMES JAMIESON Surgeon at Kelso.*

A Carpenter in this Place, thirty six Years of Age, of a thin Make of Body, asked my Advice about the middle of *February* 1732; his Complaints were, Pains at the Heart, in the Pit of the Stomach,

mach, both Sides of the *Thorax*, and betwixt his Shoulders; a great Difficulty in swallowing, and frequent Inclination to vomit. He told me it was about six Years, since, upon a sudden Grief, he was first seized with the Pain, and frequent Palpitations at his Heart, and that the other Symptoms came on gradually afterwards, but never kept him from his ordinary Work till now.

At my first Visit I took twelve Ounces of Blood from his Arm; the Blood was fizy like that in a Rheumatism. Next Day he took *Pulv. Ipecacoan. Drach. sem. Tartar. Emet. Gr. ii.* which purged him four or five Times, but did not occasion the least Nausea. I gave him also Doses of the *Pilul Gummos.* twice a Day, washing them down with *Decoct. Amar.* in which a small Quantity of *Sal Absinth.* was dissolved; caused the pained Parts to be fomented with a strong Decoction of the Aromatick Plants, and applied a large Plaister of *Theriac Andromach. Ol. Mac. per express.* and the Powder of the carminative Seeds. The Blood-letting gave him some Remission of Pain, and was repeated twice in the two following Weeks, with some short Relief each Time.

Finding however his Complaints rather increase, I obliged him to call a Physician, which

which his Poverty had made him obstinately refuse to do hitherto; and while Dr. *Abernethy* was sent for, he shewed me a hard painful Tumor immediately below the *Cartilago Xiphoides*, which he said he had only discovered the preceding Night.

The *Doctor* suspecting from the Account the Patient gave of his Disease, and from the Appearance of this Tumor, that an Abscess was forming in the Stomach, ordered him a Milk Diet, and Lintseed Tea, or a Decoction of *Hedera Terrestr.* or Milk and Water for ordinary Drink, and caused an emollient Cataplasm to be applied to the Tumor.

He continued to turn gradually worse, till about the Middle of *March*, when he was attacked with a Vomiting, which none of the different Stomachicks nor Opiats given him could restrain, but were thrown back again as soon as swallowed. His Thirst became excessive and perpetual; but all his Drink, though taken in very small Quantities at a Time, was vomited as quickly as his Medicines, without increasing his Pains; and a *Singultus* soon came on, which continued till his Death.

He passed very little *Fæces* by the *Anus*, and these were generally procured by gentle Clysters.

His Urine was for the most Part limpid,
when

when there was any Sediment, it was white.

During the whole Course of this Disease; the Patient's Pulse was never quick or strong, but low and languid, and sometimes intermitted. His Pains were always most severe in the Night; and at last deprived him almost entirely of Sleep; and for a whole Month he did not ly down, but sat in the Bed, or on a Chair bended forewards with his Head on a Pillow. In this melancholy Condition he languished till the first of *April*; when he died.

On laying open the *Thorax* and *Abdomen*, we observed a prodigious large steatomatous Body; which filled a great Part of the *Thorax*, being grown to the *Pleura* in both Sides, to the larger Share of the *Mediastinum* and *Pericardium*; and then accompanying the *Oesophagus*, they passed together through the *Diaphragm*, having enlarged the Passage in this Muscle considerably, and straitning the *Oesophagus*. After entring the *Abdomen*, it was stretch'd along the *Dorsum* of the Stomach to the *Pylorus*, which it also compressed greatly. Both the Orifices of the Stomach being so much contracted, that I could scarce push my Finger through either. I was about to have cut out this whole Tumor, to measure and weigh it, but was opposed by the

Relations; and therefore behoved to content my self with examining its Substance as it lay in the Body. It was so hard, my Knife could scarce cut it, but after a transverse Incision, several Sinuses formed in the firm white Substance discovered themselves; some of them contained a Matter like a *Meliceris*, in others, it was a-kin to that of the *Atheroma*, and in a third sort it was purulent and fetid.

The Fat of the *Omentum* was all wasted, but all the other *Viscera* were found enough.



XXVII. *Of the Service of a warm Bath in a bilious Colick; by ROBERT PORTER, M. D. Member of the College of Physicians, London.*

IT is not my Design to describe the several kinds of Colicks, their Contradistinction from each other, and their different Methods of Cure; my Purpose being to recommend one particular Method of managing the bilious Colick, and those severe ones, whose Cure depends on procuring an entire thorough Discharge of that acrid Matter within the Intestines, that
causes

causes the Disease (though not properly bilious, because unattended with such Vomiting) which seems but little attended to, yet will appear from Reason and Experience to be so highly useful, and so absolutely necessary, that this Distemper ought never to be treated without such additional Assistance.

The Description of this Disease by *Sydenham* (a) is so just, that in this Point nothing can be added to him. It will also readily be confessed, That the grand Indication of Cure, is to obtain an open Passage through the Intestines for a perfect Discharge of that acrid irritating Matter contained within them. As this therefore is the true Cause of the Disorder, to the grand Point of its Evacuation should the whole Method be directed.

But such is the Alteration produced in the Cavity of the Bowel, by the constant sharp *Stimulus* of this acrid Matter, that it is not only contracted into an unusual Narrowness, but, if the Observation of Authors of unquestioned Veracity may be credited, the Coats of the affected Intestine have been found, upon Dissection, so closely joined, and so entirely precluding

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(a) Sydenh. Sect. 4. cap. 7.

ding any downward Passage, as if they had been strongly (a) girt round with a Ligature.

But the Circumstances of the *Ilium* Bowel, produced by this sharp Irritation in these Colicks, will be perfectly understood, and cannot possibly be better explained, than by transcribing that most beautiful Passage from *Peyerus*, where he relates an Experiment he made on a living Frog, that happily sets this Matter in the clearest Light; not only visibly explaining the Effect of a severe Colick on the Intestine, but representing at the same Time, the Manner in which its frequent direful Consequence, the Iliac Passion is produced.

Torminum genesin, atque introsusceptionis conceptionem, anni superioris æstate, Ranæ jucundo admodum & utili experimento oculis nostris exhibuerunt. Etenim intestina, vivente amphibio, laceffita in diversis locis, pertinacissime mox se constringebant, contentis violenter sursum deorsumque qua data porta, protrusis; atque hinc inde in cumulos quasi congestis: unde quædam intestini portiones valdè impletæ ac turgidæ, quædam prorsus inanes & ar-
ctissimè

(a) Peyer. de Gland. intestin. cap. 9. p. 81.

etissimè clausæ perstiterunt; donec solutâ fibrarum stricturâ meatus liberior redderetur: Intestinis autem hinc inde se constringentibus, & sive chylum, sive faeces sursum deorsumve projicientibus, factum, ut illæ alicubi in molem adgestæ parietes intestini plus debito ampliarent: quod in sacci morem dilatatum intra se recepit contractam inferioris intestini portionem, eamque sinu suo absconditam aliquamdiu retinuit: donec fibris se denuo exporrigentibus, intestinum è latibulo alterius, in apricam pristinamque sedem rediret.

If such then is the Bowel's Contraction in the Severity of this Disease, one grand important Point to facilitate this Evacuation on which the Cure must turn, seems to be the *Removal of that Stricture*; and by relaxing the Tightness of the Intestine, to procure a freer and wider Passage for the Discharge. For unless this be jointly endeavoured, in conjunction with the other Method of Cure, I apprehend we do not assist the Patient with *all* that our Art might contribute to his Relief. Nor do I know any thing so effectual to this desirable End as the *warm Bath*; which is daily found so highly advantageous in somewhat a similar Case; I mean the Discharge of Gravel from the Kidneys.

I am not so foolishly prejudiced to imagine the Bath *alone* would prove effectual, or ought *singly* to be confided in, for the Cure of these Colicks: I hope I shall not be so understood; the whole I would endeavour is to propose, and prove it a very efficacious Assistant, joined with the other known, and usual Methods, and what will greatly foreward the happy Effect of them.

But since I have mentioned a Nephritic Disorder, as somewhat a parallel Case I beg leave to run over the several Indications of Cure in that Disease; from whence the near Similitude of managing both will readily appear; and the Advantage of the warm Bath in one, be no small Encouragement to its Use, and Evidence of its Service in the other; because the *Manner* in which it is useful, is in *each* the *same*.

It will be readily confessed the grand Point here is the Evacuation of that fabulous Matter lodged in the *Pelvis* of the Kidneys, or stuffing up the Ureters. The Methods to effect this are, immediate Bleeding, to remove the Tension and Inflammation of them; by widening, as much as possibly can be, the Capacity of the Ureters, for the Passage of these gritty Concretions; for which Purpose the Injection of emollient Clysters has a double Advantage;

tage; both as they convey an Internal Fermentation to those slender Tubes, by this Warmth relaxing their Contraction, and, by unloading the lower Bowels of any accumulated *Fæces*, they remove their lateral Pressure against the Ureters. To open yet more this Passage, the warm Bath proves of most important Service: For by this Warmth and Humidity, the abdominal Muscles, *Peritonæum*, and Intestines; are greatly relieved from their Tenseness; and the Diminution of their former Pressure allows a readier Discharge of the Gravel. Hence also the Bladder is considerably relaxed; consequently the oblique Insinuation of the Ureters, through its several Membranes, is less liable to obstruct the Evacuation of this sandy Matter into its Cavity.

By moderate Diureticks, by the Use of oleaginous, emollient, and deterfive Medicines, this Discharge is greatly assisted, and the Passages themselves at the same Time properly lubricated, to facilitate the Expulsion, while the Severity of Pain is suspended by *Anodynes*, that produce also a kind of paralytick Resolution of the spasmodick Contraction of the Ureters on the Gravel (by which convulsive Effort to expel, they entirely preclude its Descent)

and therefore contribute not a little even to open the Passage.

These appear the most considerable Methods for the Relief of this Disorder, which is but imperfectly managed, without the united Assistance of *all*; and which used together, seem the utmost Art can furnish.

Let us now examine the Methods of relieving these Colicks. By instant Bleeding the Tension of the Bowel is in some Measure eased, a timely Revulsion is made from the Blood's Impulse on the affected Part, an Inflammation, with its Consequences, is prevented; By giving immediately brisk Catharticks, we propose to urge forcibly forward the obstructed, acrid, morbid Matter; and by the subsequent use of more lenient and less stimulating Medicines, to assist the Operation of the former with less Violence; and, by the joint Assistance of Anodynes, not only to procure a Suspension of Pain, but to diminish the convulsive Contraction of the Intestine. So far the Curative Intentions in either Disease seem to quadrate with each other. The Injections indeed of Clysters here are of little Significancy; for they cannot pass beyond the Valve of *Tulpius*, placed at the *Ilium's* Entrance into the *Cæcum*; consequently their Warmth cannot relax the

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affected Intestine, nor their purgative Quality dislodge the obstructed Matter. Still the Patient and Physician continue alike disappointed; the Excess of Pain remains, and the Body, obstinately costive, eludes the united Effort of this Method. The Repetition of the more violent Purgatives, by the Strength of their acrid *Stimulus*, provokes a firmer Tightness and Contraction; and by this Means they partly frustrate their own Operation; yet the milder have already proved too weak to effect any Thing. By enlarging the *Anodynes*, his Pain is but momentarily mitigated; and even these, by the Costiveness they occasion, are liable in some Degree to prevent a Discharge; yet the Patient can never be safe; nor can the Disease ever be cured, without procuring a thorough Evacuation.

But what will be the Consequence of this obdurate Obstruction? Either certain Death; or the Contents of the smaller Intestines, the Medicines and the Liquids the Patient takes, if not returned by Vomit, are together stopped at the contracted Part, and, with the rarified Air contained here likewise, dilate greatly the upper Portion of the Bowel, to a very wide Amplitude, while that below the Contraction is empty, close, and undistended; till by violent
straining

straining in the Torture of this Agony, the contracted Part of the Intestine is forced upward and inward within the widened Part, too greatly stretched not to admit a ready Introsusception, one being so preternaturally straitned, and the other immediately contiguous so vastly widened beyond its natural Dimension. This is the true, the formidable Iliack Passion, in which the Vessels surrounding the Coats of the Intestine are doubled; the Circulation through them instantly prevented, and a swift Mortification immediately follows. All which might certainly have been prevented, if the single Point of the *intestinal Stricture* could have been removed, to make Way for the Evacuation; nor could the strongest Catharticks forcibly break through it. Should we not then attend to this Point with great Diligence, and apply to obtain it, a Method so certainly serviceable in the Nephritick Case, by enlarging the Ureters? *Sydenham* (a) indeed in his Discourse on the *Iliack* Passion, which he supposes produced by the sharp Irritation of acrid Matter, seems partly to propose relaxing the contracted Bowel, by his Method of applying an animal Warmth to the pained Part

(a) Sect. I. cap. 4. p. 41.

Part of the *Abdomen*, laying a large Puppy on it; though I confess his principal View appears to have been by this Heat to strengthen the weakened Intestine, agreeable to what he lays down as the second Indication of Cure; but he hints at no such Indication in his Chapter on the bilious Colick: Yet here only is it likely to be most advantageous, before the Case has proceeded so far as to terminate in this dreadful Symptom.

Shall we imitate this truly great Man, and endeavour to improve on his Method, by fomenting with emollient Decoctions the pained Part, and thus endeavour to direct and determine their Effect to the very Point where the Severity of Pain is complained of? But this will prove an insufficient, a defective, and a partial Method, while an Immersion in a warm Bath, prepared of the same Kind of Decoction, is an universal *Fotus* to the lower Trunk of the Body: Besides that, such a Quantity of relaxing Moisture cannot be imbibed by the bibulous Vessels, from the expressed Flannels, as must be absorbed from the surrounding Fluid itself; where, used as a Bath, the Application to the Part is the same, the Warmth is equal, and the Extent of its relaxing Influence perfect and general on all
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the abdominal Region. It may also be worth Enquiry, whether the Pressure of the Water has not some superior Influence to urge a larger Proportion of Fluid into those absorbent Vessels.

We see then how nearly allied these two distinct and widely different Diseases are, in their respective curative Indications; the grand Article of relaxing, opening and procuring a free Passage being of equal Importance in both. I dare not contend indeed, that the Decoction of emollient Plants actually carries any superior Virtue in it beyond simple warm Water; for the gentle Heat and Humidity of the latter may prove as sufficient for the Purpose. Yet, as the worst that can be said of this artful Disguise is, that it is a needless Pomp, the *pia fraus* deserves to be continued; for the Patient would be too apt to entertain a low, a thankless Opinion of his Physician's Merit or Depth, that effected his Cure by so simple, so naked a Remedy.

Upon the whole, I would not be apprehended to advance the Notion, that *no* bilious Colick can possibly be cured without warm Bathing: The contrary is every Day experienced; for in the milder Kind, where the intestinal Stricture is far less streightened, the Obstruction more readily yields
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to the Force of Catharticks: Yet even here, in Proportion to the Abatement of this Tightness, the more speedily will it assist in resolving it, the more conducive will it be to quicken the Operation of internal Medicines, to hasten the Patient's Relief, and prevent any subsequent Danger; for which Reasons I should not even in such Case, and at the Beginning of the Disease, omit it: And I am perswaded, in the severer Kind, Necessity indispensably commands us to use some Method for relaxing the Bowel, that an Evacuation may be timely obtained; and cannot but believe many an Iliack Passion might have been happily prevented by an early Conjunction of the warm Bath, with the other Manner of Cure.

But it is justly expected from every medical Writer, that he should confirm, and establish from Experience, and the Authority of repeated Trials, the real Efficacy of that Method he recommends; for unless the Sanction of Fact is on his side, all the Flourish of laboured Reasoning, and Pomp of probable Argument, is but ridiculously vain; a barren Superfluity of Words, a *vox, & præterea nihil*. But this, though a necessary, is yet a painful Task to every modest Author; for even the simple Narration

tion of successful Truth, is so frequently construed a vain-glorious Boasting, and carries such an Air of Ostentation with it, that the censorious World too often, sometimes too truly, conclude the History was not so much added to confirm the preceding Argument, as the Argument designed to introduce the subsequent self-applauding Story.

I shall however give some few Instances, wherein I have experienced the Success of this collateral Aid of the warm Bath: The first I produce is the Case where I first used it for this Purpose; and the happy instantaneous Relief was, as far as a Matter of this Nature can be proved, evidently and intirely owing to it.

July 13. 1731.

A Gentleman of *Spittlefields*, about Thirty, of a moderate Habit of Body, by drinking adulterated bad Wine in a Journey, was immediately seized with a violent Pain in the smaller Bowels; which increased daily, attended with an intire Costiveness: On his Return he immediately applied to his Apothecary, who prudently attempted to remove the Obstruction by various pertinent Methods; as Bleeding, and the Stimulus of rougher Catharticks:
Which

Which proving ineffectual, he tried the laxative Method of more lenient Medicines, a Solution of Manna in purging Waters, attended with oily Draughts; not omitting the proper Use of *Opiates*, to relieve the convulsive Spasm of the Intestine; he had also injected several Clysters of the softer and the strongly irritating Kind.—In vain. I found him in the utmost acute Pain, as if a Cord had been forcibly strained round the *Abdomen*, attended with frequent vomiting of yellow, viscid, bilious Matter; and attempted once more the Effect of a smart Cathartick (*Extract. Rudii Drachm. sem. Calomel. Gr. xv.*) followed with a *Decoct.* of *Fol. Senn.* and *Rad. Rheiz*, with the Addition of *Elix. Salutis* and *Syr. Ros. Solutiv.* of which he took two Spoonfuls every Hour. I waited on him in the Evening, but he had received no manner of Benefit from this Method, his Torture continuing without any Abatement, with the same inexpressible Agony. I resolved therefore to try what might be the Advantage of a warm Bath, by relaxing the Intestine, and opening the Passage: One was instantly prepared from a Decoction of the most emollient Plants; and such was the happy Consequence, that even while he was in it he had a loose Stool, soon followed by five more

more, though he had but one for ten Days before. This copious Discharge terminated his Disorder; the remaining Tenderness of his Bowels being soon relieved by an Opiate, and a Solution of *Sperma Ceti*.

August 28. 1731.

I visited—— Eaton a Child not quite five Years old, who was seized the 22d of the same Month with a vehement colicky Pain immediately after eating two large raw Codlings: Several Clysters had been ineffectually thrown up, and several Catharticks as fruitlessly taken internally; for the Child had had as yet no Stool: I found the Abdomen greatly swelled and hard, with excessive Pain; the Pulse was frequent and strong; the Respiration quick, laborious, and indeed struggling. Bleeding was immediately performed; and the Blood drawn away was covered on its Surface with a leathery Substance, equally thick and hard with that of any adult, robust, pleuritick Patient I had ever attended. He took instantly *Pil. Coch. Min. Gr. viii. Calomel. Gr. iii.* in the Form of Pills; and within an Hour began the Use of the Mixture following, *℞. Fol. Sennæ Drach. i. Rad. Rhei Scrupul. i. coque in aq. Fontan. q. s. Colaturæ Unc. iii. adde Elix. Salutis, Mannæ*

Manna an Unc. sem. M. Sumat. Cochl. ii. omni hora donec responderit Alvus. A warm Bath was prepared from a Decoction of emollient Plants; he drank also frequently a Solution of *Manna Unc. sem. in Unc. iv. of Decoct. Pectorale.*

In a few Hours, after twice using the *Semcupium*, and taking a proportional Quantity of the other Medicines, the Obstruction was happily removed, and five copious Dejections concluded the Disease; the greatest part of the Apples returned crude and unaltered, with the Stools.

October 3. 1732.

— *Casseck*, a Plumber about Forty, was seized September 30th with a violent Colick, soon aggravated to great Intensity of Pain; either alternately fixed and contracted to a Point, or strongly surrounding the Abdomen like a tightened Girth, and had received no Evacuation by several Catharticks and two Clysters administered to him. The keen Severity of his Pain extorted loud and constant Screams from him. His Pulse was strong and full; wherefore Blood was immediately drawn, and a Dose of *Pil. Coch. Min. cum Calomel.* prescribed: An Hour after which he entered on the Use of the following Medicine:

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℞ Fol.

℞ *Fol. Sen. Drach. iii. Rad. Rhei Drach. i. coque in aq. Fontan. q. s. Colaturæ Unc. vi. adde Elixir. salutis Unc. i. sem. Mannæ Unc. i. Sal Glauberi Unc. sem. M. summat Cochl. iii. post elapsam à pilulis horam, dein Cochl. ii. omni hora.* He used the *Semicupium*, made of emollient Herbs, twice a-day, half an Hour each Time.

4th, His Agony increased so violently last Night, that five Men could with Difficulty overpower his struggling, and detain him in Bed: To quiet this Severity, I ventured on *Gr. i. sem.* of crude Opium; by it his Pain was greatly mitigated this Morning, but without any Stool. He continued this Day in the constant Repetition of the same opening Mixture, and the Bath, as before: Whence the Morning of the next Day he had five large Stools, and with them an End of his Misery and Disorder. A Solution of *Sperma Ceti* finished his Cure, by removing the remaining Soreness of his Bowels.

May 3. 1733.

—— Lord, a Plumber also by Business, a robust Man, about thirty five, was taken with a strong Pain in the smaller Intestines, *April* the 29th, that seemed like a tight Bandage to gird the Abdomen round. He was the Patient of an Apothecary, to whom

whom I had frequently and strenuously urged the Use and Necessity of warm Bathing in severe Colicks: He had therefore from the Beginning prudently joined this with the other Method of strong Catharticks, but without any Effect; I found his Pulse hard and strong, his Pain increased to perfect Agony, either determined to a Point, and piercing his Body through, or at other Times binding forcibly the Abdomen round. I attempted his Relief in the following Manner:

Extrahantur è Brachio sanguinis Unc. xvi. statim. ℞ Extract. Rudii Scrup. i. Calomel. Gr. xv. f. Pilulæ statim sumend. superbibend. prorsus nihil: Tribus vero elaps. horis capiat Coch. ii. misturæ sequentis. ℞ Fol. Sen. Drach. iii. Rad. Rheiz Drach. i. Sal Glauberi Unc. sem. coque in aq. Fontan. q. s. Colaturæ Unc. vi. adde Elixir. salutis Unc. i. sem. Mannæ Unc. i. M. capiat Coch. ii. omni hora. Pergat in usu Semicupii. This he used half an Hour twice or thrice a-day.

4th, As yet he found no lasting Abatement of Pain, though the Bath constantly mitigated his Agony, while he continued in it; nor was any Stool obtained, though he had taken the whole of the opening Mixture: Wherefore the following more quick-

ning Medicine was prescribed, *R. Extract. Rudii, Calomel. an Scrup. i. Resin. Jalapp. Gr. vi. f. Pilula quamprimum sumend. R. Fol. Sen. Unc. sem. Rad. Rhei Drach. ii. Sal Glauberi Drach. vi. coque in aq. Fontan. q. s. Colaturæ Unc. ix. adde Elixir. salutis Unc. ii. sem. Mannæ Unc. ii. M. Capiat Cochl. ii. post tres, ab assumptis Pilulis, horas 6 dein omni hora.*

He still kept to warm Bathing as before. I visited him again in the Evening, but found no Benefit yet received, the intestinal Obstruction continuing equally obstinate, with equal Pain. His Pulse remaining still full and hard, *Unc. xii.* of Blood were again drawn away, which, like the first, was greatly inflamed; he continued still in the constant Use of the aperient Mixture. The next Morning his Body was happily opened, yet not before a Consumption of one and a half of the last prescribed Medicine: So difficult was it to get an open Passage! Yet the following Day our Patient complaining of a pleuritick Pain, and his Pulse continuing very hard, strong and full, his Vein was opened a third Time with Success.

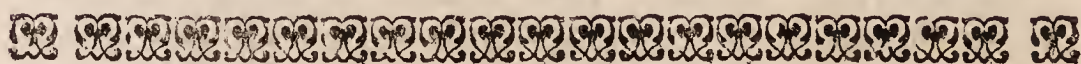
I have thus honestly related a few Cases, wherein, I apprehend, the warm Bath did considerable Service: Its remarkable Advantage

vantage in the first Instance sufficiently encouraged me to make repeated Trials of its Efficacy ; and I am convinced it ever greatly assisted and promoted the Operation of Catharticks, and greatly forwarded the Patient's Recovery.

I suppose it will scarcely be urged on the contrary, that it as evidently appears from most of these very Histories, that the Bath was frequently repeated before the Work could be performed ; consequently its Virtue was of little Avail, nor worth the Trouble of preparing : But where the Obstruction is great, where the Tightness of the Intestines is obstinately firm, the Strength and Repetition of Catharticks must be proportional, the Frequency and Continuance of Bathing must be kept to without Weariness, that the Virtue of this united Method may at length prevail. In Nephritick Cases, the Bath, and all the other known Methods of Cure, must sometimes be long persevered in, before the fabulous Matter, lodged in the Kidneys, or plugging up the Ureters, can be brought away ; because therefore it has not an immediate Effect here, we shall not rashly pronounce it of no Benefit : For, as in the Intestines, the relaxing every Stricture, and opening every Obstruction, will be earlier

or later, as is the Degree of their Strength, Duration and Tightness.

On the other hand, I am far from attributing these Recoveries *singly* to the Bath, *exclusive* of the Help from internal Catharticks. But when I consider the very Nature of this Distemper, the Manner in which it affects the Intestine, the Continuance of the obstinate Costiveness, the Severity of their Torture, (ever mitigated by Bathing) and the large Quantity of Catharticks of either Kind taken before the Passage was made; I cannot help concluding the *Semiscupium* was really and highly useful in their Relief; greatly forwarding their Cure, and preventive of worse Consequences that would have arisen from a continued unre-moved Obstruction. In this single View of an *Assistant* to the other Methods of Cure I endeavour only to propose it.



XXVIII. *The Water of a Dropsy evacuated at the Navel; by Dr. FRANCIS PRINGLE, late President of the College of Physicians at Edinburgh.*

IN June 1726 I was desired to visit a Woman betwixt forty and fifty Years of Age, who

who had laboured under a *Hydrops Ascites* some Years, and in that Time had taken a great many Medicines by the Direction of a Physician. The most powerful Diureticks and hydragogue Purgatives were given by another Physician and me in vain, the Bulk of her Belly, which was very great when I saw her first, rather increasfing; so that at length, despairing of doing her Service by Medicines, and she refusing to undergo the *Paracentesis*, we gave over prescribing for her.

Having one Day taken a pretty brisk Purgative, she told me that the Waters ouzed out a her Navel: This Ouzing continued constantly after, but was flow and gentle, giving her no other Uneasiness than what was occasioned by wetting her Linens. She remained in this State all the Winter, without her Belly increasfing, but her Flesh and Strength wasted.

In *May* 1727 having gone to *Leith* in a Coach, in returning home, the Orifices at the Navel were so dilated that the Water gushed out in a Stream, as if she had been tapped; and with great Difficulty she was carried from the Coach to her Lodgings, where the Waters continued to flow plentifully, while I was sent for, the People about her computing that she had discharged between 12 and 16 *Scots*

Pints of Water. When I came, she was so faint, her Pulse so sunk and her Looks so ghastly, that I found it absolutely necessary to put a Stop to any farther Discharge of Water at that Time, by proper Compresses and Bandage, and then ordered her to be laid in Bed with her Head low and her Feet raised. She passed the Night indifferently, but recovered her Pulse and Spirits. Next Morning a Chopin more of Water ran out, when the wet Dressings were changed for clean ones, and that Day she was seized with a Fever, attended with violent and threatening Symptoms, such as Vomiting, *Hiccough*, and *Asthma*. The Fever continued in this Way some Days, but at length she recovered intirely, and continued that Summer and most part of Autumn in a perfect State of Health. Her Belly not being in the least swelled, and her Flesh, Strength, Colour and Appetite being recovered.

In *October* she was seized all of a sudden with a Colick, attended with violent Vomiting, and an obstinate Constipation, which cut her off in a few Days.

Upon opening her Body there was no Water nor any remarkable Disorder found in the *Abdomen*, except that the *Uterus* was vastly large, being schirrous all over, with its Coats greatly thickned. It weighed four Pounds and a half.

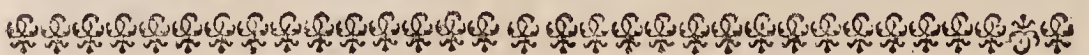
XX

XXIX. *The Menstrua regularly evacuated at an Ulcer of the Ankle; by Mr. JAMES CALDER junior, Surgeon in Glasgow.*

A Healthy, vigorous, labouring Country Girl, of an ordinary Stature, strained her right Foot at fifteen Years of Age, and again at nineteen, when a sordid Ulcer broke out in it: This being healed up in three Weeks, she soon after complained of a Disorder through all her Body. At twenty Years of Age her *Menstrua* appeared for the first time, but in very small Quantity.

The former Disorders still continuing, she was blooded at the *Vena Saphæna* of that right Foot. Soon after which an Ulcer was formed in that Ankle, which has now continued above five Years, a considerable Share of the *Os calcis* having come out. This Ulcer sent out in two or three Days of each Month, as large a Quantity of Blood, as Women generally pass in their Courses, and this in regular Periods, without any Bleeding at the intermediate Time. Some Days before this periodical *Hæmorrhagy*, she always complained of great Pain in her Foot, which became tolerably easy

easy, as soon as the Evacuation was past. She continued in this Way till, in *May* 1733, the Bones being cast out, and the Ulcer beginning to heal up, while her Body turned more plump and strong, the *Menses* came the natural Way, in much the same Quantity, and continuing the same Time they used to do at her Foot, which bled none. She had a second natural Return of the *Courses* in *June*, but in *July* she passed the natural Period, and her Foot became more painful; but the *Menses* returning as in other Women, the Pain ceased; and she has ever since that Time been in good Health, with her *Menses* regular in the natural Way, without any other Evacuation than of a small Quantity of *Pus* at the Ulcer, which still continues a little open.



XXX. *An Account of Medical Discoveries, Improvements and Books published in the Year 1732, and omitted in the second Volume of this Collection.*

Discoveries and Improvements.

SEveral Anatomists, particularly Messrs. *Heister* and *Palsyn*, having of late disputed whether *Steno's Duct*, between the
Nose

Nose and Mouth, is pervious in the recent Subject, as well as in the Skeleton; Dr. *Kulm*, Professor of Medicine at *Dantzick*, affirms, That he has found and demonstrated it to several, to be pervious in a Deer, a Bear, wild Goats, Hares, Calves, Dogs, and in the human Subject, and then mentions the Manner of tracing it. He says there is a double Opening of this Duct into the Mouth at the *Papilla*, immediately behind the *Dentes incisores*, out at which Orifices a Liquor bubbles, when the Palate is pressed with the Fingers from behind forewards, by which one is directed to introduce a Hog's Bristle into these Canals; and by pushing the Bristle first perpendicularly, and then a little Backward, it very easily passes into the Nose. Besides, says he, the Place of these Ducts in the Nose may be readily distinguished by its greater Declivity, *Tabul. Anat. XI.*

Dr. *Pozzi*, Professor at *Bologna*, endeavours to prove in the *Commentariolum* tacked to his Orations, *p. 55.* that the Nails grow out from the Tendons that are spread on the last *Phalanx* of the Fingers and Toes.

P. 58. He says, That the *Thymus* of a Calf, softened by Maceration, discovers a Lobe from which a milky Liquor runs out when it is wounded; and if Air is afterwards

wards blown into it, the whole *Thymus* is distended, and may be dried, when it plainly appears to be composed of Cells communicating with each other; upon the Sides of which Muscular Fibres are to be seen. From which Structure he concludes, That the *Thymus* in *Fætuses* supplies the Use of the Lungs, serving as a Receptacle for the Chyle to be prepared in.

P. 72. Our Author relates the *Phænomena* he remarked in dissecting a Dog, whose Spleen was cut out when he was very young. The Liver, which was larger, and more heavy than ordinary, was also become more brittle. The *Vena portarum* was enlarged. The Gall-bladder was full of Bile, the Colour, Consistence and Taste of which discovered it to be more acrid than it is commonly. From these Appearances he is led to think the Use of the Spleen to be for separating a Liquor like to Spittle, which may dilute the Bile, and prevent its too great Acrimony.

B O O K S.

Dissertationes duæ, de viribus medicatis olei animalis in Epilepsia, aliisque affectibus convulsivis, 8vo, Londini.

A new *English Dispensatory*, by James Alleyne, M. D. 8vo London.

Tho-

Thomæ Fieni libri chirurgici duodecim de præcipuis artis chirurgicæ controversiis, editio 2da, 4to, Londini.

Prosodia chirurgica; or a *Memoria technica*, calculated for the Use of old Practitioners, as well as young Students in Surgery; being a *Lexicon*, wherein all the Terms of Art are accounted for, their most received Sense given, and an exact Definition of them from the best *Greek* Authors: Also their Pronunciation as to Quantity determined by proper Marks over each Syllable. The second Edition, 12mo, London.

Giustificazione di Antonio Benevoli, Cerusico e maestro delle insigne spedale di santa Maria nuova del citta di Firenze, dalle replicate accuse del Signior Pietro Paolo in Lucca, 4to, Florent.

Antonii Vallisneri *Opere mediche e Fifiche*, Tom. 2. Fol. Venet.

Nuove ed erudite osservazioni, Storiche, mediche e naturali del Dottor Girolamo Caspari, Medico primario di Feltrè, 8vo, Venet.

Saggio di Medicina Teorico-practica di Carlo Gianello, 8vo, in Venezia.

Observationes de Febris præcipue intermittentibus & ex earum genere continuis, deque earum periculis ac reversionibus prænoscentis & præcavendis per medelam

delam tempestivam, efficacem, adequatam, candide & perspicue propositam. Autore Paulo Gottlieb Werlhof, M. D. 4to Hannover.

A Discourse concerning Fevers, in two Letters to a young Physician. The second Edition, 8vo, London.

Friderici Hoffmanni *Medicinæ rationalis Systematicæ, Tomi 4ti, Pars 2da, 4to, Halæ Magdeburg.*

XXXI. *An Account of the most remarkable Improvements and Discoveries in Physick made or proposed since the Beginning of the Year 1733.*

DR. Boerhaave, Professor of Physick at Leyden, has communicated to the Royal Society at London, several accurate and very laborious Experiments concerning Mercury. The Result of them may be summed up in these few Articles.

1. *Quick-silver*, however well purified, by passing through Leather, washing, or Distillations repeated ever so oft, yields always a soft black Powder of a sharp brassy Taste, when long exposed to violent Conquassation, or to a Degree of Heat about twice as great as that of Animals.

2. Heat

2. Heat near as strong as what is necessary for distilling Quick-silver, changes the greater Part of *Mercury*, if not all of it, into a heavy, shining, red, friable Powder, of a very sharp, metallick, nauseous, penetrating Taste, which one can scarce free his Mouth of, that long and violently disorders the human Body, and disposes it to Excretions.

3. The Fluid *Quick-silver* remaining after this red Powder is separated, is more fluid, and of less specifick Weight than common Mercury.

4. All the *black*, and very near the whole *red* Powder, can be brought into the former fluid State, by a more intense Heat; and this revived Quick-silver enjoys all the Properties of common Mercury, and serves as well for repeating the same Experiments.

5. The small Part of the *red* Powder which is not revived, can scarce be raised by the Force of Fire, and becomes of a dusky Colour, swelling like a Sponge, and vitrifies by the Addition of some *Borax*; but when tried with Lead it flies off.

6. *Quick-silver*, when distilled by itself, or in Water, requires a very strong Heat to raise it; but if it is previously reduced to a black Powder, by amalgamizing it with one fourth Part of Lead, and then is put among

mong Vinegar, the Quick-silver rises before the Vinegar boils. *Philosoph. Transact. Numb. 427. § 2.*

In *Pag. 385. of Vol. II.* we mentioned *Quick-silver* being the fashionable Medicine at *London*, since which it has been given here at *Edinburgh* in several Forms, different from those commonly in use before. Tho' several have taken an Ounce or two of *crude Mercury* each Morning of several Weeks; we know no Instance of its increasing any of the sensible Evacuations, but have been told, that some who used it thus, had passed some of it with their Urine, and that the Hands of others under this Medicine, had gilded their Snuff-boxes and Heads of their Canes.

Quick-silver rubbed violently with a double Quantity of *Crabs Eyes*, or of Sugar Candy, till it is extinguished, when it goes by the Name of *Mercurius Alkalizatus*, or *Æthiops albus*, tho' it has been taken by some without any sensible Effect, yet we have had the Experience of a very small Quantity of it having raised a high Salivation to others.

Mercury, extinguished in *Prunells*, has operated much in the same Way with the *Æthiops albus*.

Quick-silver dissolved, by rubbing it strongly

strongly with any chemical Oil, or with *Venice Turpentine*, has been given to the Quantity of a *Scruple*, half a *Drachm*, or two *Scruples* in a Day. Such Pills keep some Peoples Belly open, others they purge, and a gentle Ptyalism has sometimes been occasioned; nay, a high Salivation has been raised by them.

Dr. *Plummer's Æthiops*, described in *Art. VI. Vol. I.* has been successful in several desperate cutaneous Diseases, and obstinate glandular Swellings, when Care has been taken by Doses adapted to the Patients, and the proper Use of gentle Opiats, or Purgatives, to prevent its running off by Stool, or its affecting the salivary Glands too much.

An Imitation of *Belloste's Pills* has also been tried; these are made by extinguishing Quick-silver in *Resin of Guajac*, then forming into Pills with a chemical Oil, or with *Ol. Tartar.* and afterwards crusting each of them over with the *Extract of Rhubarb.* These purge gently. We have not heard that they increased the Excretion of *Saliva.*

Crude Antimony is recommended in Palsies, Pains and Numness that come on after a Salivation, and is said to have cured several who were Paralytick from other Causes. The Method of giving it, is to begin with three Grains, increasing the Dose with three

B b

Grains

Grains every Day, till the Patient takes half a Drachm at once; after which the Dose is diminished three Grains every Day, till it comes down to the Quantity of the first Dose. *Commerc. Literar. Norimberg.* 1733. *Hebdom.* 2. § 2.

The *French* Physicians are at present much divided in their Opinions concerning the Medicine so famous at *Paris* in 1719 and 1720, under the Name of the Powder of the *Chartreux*, which is now generally named *Kermes Mineral*. It is the *Sulphur of Antimony* prepared, by pouring a dissolved fixt *Alkali Salt*; for Example, *Ol. Tartari per deliquium* upon the Powder of *Antimony*; and after digesting them in a Sand-heat for a Day, to make the Liquor boil two Hours, when it becomes of a very red Colour; and being poured off into another Vessel, lets fall a red Powder, which is freed of the *Alkali Salt*, by washing it frequently with Water; after which it is dried and kept for Use. Half a Grain, or a Grain of this Powder given every three or four Hours, produces no violent Effects; but by increasing the Dose, it may be made to vomit, purge, and sweat. Some commend it in their *Theses* and Pamphlets, as the most universal Resolvent and Deobstruent, assuring us, that it almost infallibly cures *Pleurisies*

rifies, *Peripneumonies*, *Asthmas*, *Catarrhs*, *Angina*, *Small-pox*, and many other Diseases. Others, on the contrary, are as positive that it heats and thickens the Blood; thereby increasing Obstructions, and is particularly hurtful in all inflammatory Diseases. Unluckily both Parties appeal to Experience, and mention Examples to support what they argue for.

By the Information we have received of the Effects of the Medicine upon which the great Run is now at *London*, we can imagine it to be no other than a Preparation of *Antimony*, and that no milder one than the *Butter of Antimony*; than which there is scarce known a more violent Destroyer of all Animal Substances, being composed of the *reguline* or metallick Part of that Mineral corroded by the concentrated Acid of *Spirit of Nitre*, or of *Sea-Salt*.

Dr. *Boeli* at *Brunswick* recommends the Powder of the Root of the *Valerian* taken into the Nose by way of Snuff, as an excellent Restorer of weak Sight, and mentions some Examples of his Success with it. As he orders it, there may be some Doubt on what the Success depends. His Receipt is, *R. Rad. Valerian. Fol. Tabac. a. Drach. ii. fiat pulv. subtilissim. adde Ol. destill. Lavendul. Majoran. a. gutt. iii. M. Act.*

Physico-medic. Acad. natur. curios. Tom. III. Obs. 125.

Sir *Hans Sloane*, President of the *Royal Society* informs us of four Children, who, after eating the Seeds of the *Hyosciamus niger* C. B. or common Henbane, were seized with great Thirst, Swimmings of the Head, Dimness of Sight, Ravings, and profound Sleep; which last continued two Days and Nights in one of them. He says the *Delirium* occasioned by these Seeds, differs from the common, and in some Measure agrees with that produced by the *Dutroa*, a Species of the *Stramonium*, and by the *Bangue* of *East India*, a Sort of Hemp.

He cured all these Children by Bleeding, Blistering in several Places, and purging afterwards, with a Medicine composed of *Elect. Lenitiv. Ol. Amygd. d. Flor. Sulph.* and *Syrup. Pæon.* which operated both by Vomit and Stool.

The same Gentleman also tells us of a Quack, who cured the Toothach, by conveying the Smoak of burning *Henbane Seeds*, by means of a Funnel, into the hollow Tooth. *Philos. Transact. Numb. 429. § 1.*

Dr. *Short* in his History of the Mineral Waters of *Yorkshire*, *Derbyshire* and *Lincolnshire* has classed them into the warm, purging chalybeat, diuretick chalybeat, purging

purging and plain Sulphur Waters.

He found the *warm Waters* to be impregnated with a Mineral Steam, Vapour, or Spirit, containing a most subtile and impalpable Sulphur, with a calcarious Earth, and some Nitre and Sea-Salt. Of those he mentions, that of *Buxton* seems to be the Principal, the Heat of which is equal, in frosty Weather, to common River Water, with which two fifths of boiling Water has been immediately mixed.

The *purging chalybeat Waters* contain a Mineral Spirit, Sulphur, Vitriol, Nitre and Sea-Salt, with a calcarious Earth, of which some Particles are attracted by the *Loadstone*. Of these, *Scarborough Spar* is now in greatest Reputation; the principal Salt of which is described and painted by our Author, as consisting of long Crystals made up of six Sides, which all concur at each Extremity in forming a Diamond Point, and he calls it *Nitre*.

The *diuretick chalybeat Waters* consist of much the same Principles with the former Class, only the Salts are in less Proportion. Of these there are great Numbers in *Yorkshire*.

The *Sulphur Waters*, besides Sulphur, contain also marine Salt and Nitre, or Nitre



Fire and Earth. Of these the strongest is *Harrigate-well*.

Dr. *Shaw*, in his Treatise on *Scarborough Waters*, previously lays down a great many Rules to be observed in the Investigation of all Mineral Waters, whereby we may be directed in our Enquiries, and may be cautioned against drawing Conclusions too hastily, which deserve to be seriously considered by all employed in Physick.

The Contents of the *purging Spaw*, which is what is chiefly used, are much the same in Dr. *Shaw's Account*, as what we mentioned from Dr. *Short*; only Dr. *Shaw* has described the first Salt, as consisting only of four Sides, of which two are broad, and two are narrow; the two broad ones, which are opposite to each other, are extended into a sharp Edge at one Extremity of each Crystal, the narrow Sides not shooting out so far; and the Reverse is observed at the other Extremity of the Crystal. He affirms this Salt to be *sui generis*, and different from all the natural or artificial Salts yet known.

This Water proves a gentle cooling Purgative; but as the Salt is in a small Quantity, the Operation of the Water is often required to be assisted by some of the Salt prepared by the Apothecaries.

Dr. *Waltherus*, Professor at *Leipsick*, after comparing the Muscles of the human Body, with the Descriptions of them published by several Authors, particularly by Mr. *Winslow* (in his *Exposition Anatomique*) has made several accurate Remarks on them, which may serve as a Supplement to the *Anatome teneriorum musculorum repetita*, which he published formerly; but as they will not admit of an Abridgement, we must refer to the Observations themselves, which are inserted in *Nov. Act. E-rudit. Mens. Jun. 1733*.

Dr. *Nichols*, Lecturer of Anatomy at *Oxford*, has, (in his *Compend. Anatom.*) contradicted the common received Doctrine of the Motion of the Heart, and of the Circulation of the Blood, both in Adults and *Fætuses*.

Prælect. XV. “ The Circulation of the
 “ Blood depends, (says he) on six Motions,
 “ 1. Of the right Auricle. 2. Right Ven-
 “ tricle. 3. Pulmonary Artery. 4. Left
 “ Auricle. 5. Left Ventricle; and, 6. Of
 “ the *Aorta*. Of these the 1st, 3d, 5th
 “ are synchronous, or act at the same Time,
 “ as the 2d, 4th, 6th likewise do; but the
 “ 1st, 3d, 5th, are asynchronous, or act at a
 “ different Time from what the 2d, 4th,
 “ 6th do; and therefore

The 2 Auricles }
 The 2 Ventricles } alternately } are relaxed,
 The 2 Arteries } } are contracted.

Praelect. XXIV. Our Author has the following Propositions concerning the Circulation of the Blood in *Fœtuses*.

“ 1. The Blood of the *ascending Cava*
 “ is fitter for Nutrition, muscular Motion,
 “ and the subtile Secretions, than the Blood
 “ that is carried to the Heart by the *de-*
 “ *scending Cava*. For the former consi-
 “ sting partly of Blood lately triturated in
 “ the Lungs of the Mother, partly of
 “ Blood returning from the *Vena portæ*,
 “ and defecated in the Liver, with the
 “ Blood brought back from the iliack and
 “ emulgent Vessels, may be looked on as
 “ arterious Blood; the latter on the con-
 “ trary being deprived of many of its more
 “ subtile Parts, bestowed on the Nourish-
 “ ment of the Fibres, or in the Secretions
 “ of the Brain, is altogether venous, and as
 “ it were weak and poor, (*effætus.*)”

“ 2. The *ascending* and *descending A-*
 “ *orta* are dilated and contracted at diffe-
 “ rent Times, or have asynchronous Mo-
 “ tions.”

“ 3. The Blood of the *ascending Cava*
 “ is pushed to the Heart, at the Time when
 “ the right Auricle is contracted, and the
 “ left

“ left Auricle is relaxed; and therefore it
“ will not pass into the right Auricle, and
“ from that into the left; but must go im-
“ mediately from the *Cava* into the left
“ Auricle.

“ 4. The Blood which is sent from the
“ left Auricle, into the left Ventricle, con-
“ sisting mostly of the Blood of the *ascen-*
“ *ding Cava*, is wholly distributed to the
“ Heart and Branches of the *ascending A-*
“ *orta*.

“ 5. The Blood which flows from the
“ *descending Cava* into the Heart, passes
“ partly through the Lungs into the left
“ Auricle, to be mixed with the Blood of
“ the *ascending Cava*, partly passes into
“ the *descending Aorta*, not to be mixed
“ with the Blood of the *ascending Artery*;
“ That the Blood which is returned to the
“ Mother may be venous, weak and poor
“ (*effætus*.)

“ 6. The *Canalis arteriosus* being shut
“ by Respiration, the *descending Artery*
“ acquires a Motion synchronous to that
“ of the *ascending Artery*; and the Blood
“ of the *ascending Cava* is sent to the
“ Heart, at the Time when the left Au-
“ ricle is contracted, and the right Au-
“ ricle is relaxed, and therefore is wholly
“ poured into the right Ventricle, along
“ with

“ with the Blood of the *descending Cava*.”

“ 7. The Contents of the *Abdomen* being pressed by Respiration, the umbilical Arteries, umbilical Vein, and the *ductus venosus* are soon shut up.

“ 8. The usual Crying of new-born Infants, contributes much to the Distention of the Lungs, and breaking down the Particles of the Blood.

The Doctor next explains a Figure he has caused to be drawn of the two Auricles of the Heart of a *Fœtus* to shew the Canals, by one of which the *Vena cava ascendens* opens into the right, and by the other into the left Auricle, at each of which he paints a Valve.

He illustrates afterwards his Scheme of the Circulation of the Blood in a *Fœtus* by another Figure, in explaining which he assumes the second and third of the preceding Propositions as demonstrated.

Dr. *Nichols's* Opinion concerning the Circulation of the Blood *in natis* & *non-natis* in born and unborn Animals, is so different from what has prevailed since *Harvey's* Time, that we cannot but wish he had been more explicite, and would add the Experiments or other Proofs that can be brought to support his Doctrine. With a View to be informed, and to induce perhaps

haps the Doctor to explain himself more fully, we shall propose one Question which naturally offers itself, upon looking at his Scheme of the Circulation in a *Fœtus*. What preserves the Form of Canals to F, (the Passage from the *Cava ascendens* into the right Auricle) and to N, (the Part of the *Aorta* between the Rise of the left sub-clavian Artery, and the Insertion of the *Canalis arteriosus*) seeing by the Explication of the Scheme there are no Liquors pass through them?

The *Cataract* is generally now agreed to be for most part the crystalline Humor rendered opack, very few Instances being brought of any Membrane lodged in the posterior Chamber of the aqueous Humor, and these have been suspected to be no other than the Membrane of the Crystalline separated. To confirm more the Doctrine of the Crystalline being the Part affected in the Cataract, Dr. *Scheuchzer* Physician at *Zurich* in *Swisserland*, communicates the Dissection of two cataractous Eyes, on one of which the Operation had been performed with Success. In the Eye which had not been couched, the Crystalline which adhered to the Circumference of the *Uvea* was of the Colour of whitish Pearl, but less bright. In the other Eye the Crystalline
was

was less, harder, inclined to a yellow Colour, and depressed below the *Uvea*. A Cloud was observed in the Part of the vitreous Humor through which the Needle had passed. *Act. Physico-Medic. Acad. N. C. Tom. iii. Observ. 36.*

The Cases in Midwifery mentioned by Mr. *Giffard*, may be reduced to these two;
 1. That the Head of the Child is fallen down among the Bones of the Mother's *Pelvis*, and does not advance with her Throws, and cannot be pushed back into the Womb.
 2. That a wrong Posture of the Child, the Flooding or Weakness of the Mother, make it necessary to bring the Child away by the Feet.

In the former of these two Cases he made Use of an *Extractor*, which is so far different from that described in *Art. XX.* of this Volume, that the Blades of it consisted each of an oval Ring bended, instead of an intire Piece of thin Steel. Dr. *Hody*, the Editor of Mr. *Giffard*'s Book, publishes with it an Improvement made on the *Extractor* by Mr. *Freke* Surgeon to St. *Bartholomew's* Hospital, which seems to consist in one of the Handles having a Joint in the Middle of it, and its Extremity being a sharp Hook or Crotchet, which has a moveable Flap to cover it, when it is not employed as a Hook

to operate with. Mr. *Giffard* observed some Times, that the *Os Uteri* gripped the Child's Head so firmly, that it could not be brought away with the *Extractor*, till with his Fingers he had dilated the Ring which the Womb made. As soon as he could catch hold of the Head with his Hands, he laid aside the Instrument. If after the Head was born, the Child stuck at the Shoulders, he endeavoured to make more Way for them, by bringing out first one Arm, and then the other; or if that could not be done, he put a crooked Finger into each Arm-pit of the Child, and so extracted it.

In the Cases where there is a Necessity of bringing the Child away by the Feet, he dilates the *Os Tincæ* by spreading his Fingers, pushes back what Parts are in his Way, or slides his Hand along them to search for a Leg: After he has brought this out, and tied a Ligature upon it, he searches for the other, but is not anxious about finding it, if it is bended upwards on the Child's Belly, or the Passage is wide enough by the Woman's having formerly born Children; for the Leg he has brought out is sufficient for bringing down the Buttocks, till he can put his crooked Finger, or the Handle of one Blade of the *Extractor* armed with Cotton into the Groin, or a Fillet put round
the

the Thigh ; with any of which, and the Ligature on the other Leg, he extracts the Buttocks. When laying hold of the Child's Body, he turns it, if there is Occasion for it, as he says there commonly is in such a Case ; because the Child has sunk down in the Womb without turning, so that its Face is forward. When the Shoulders are brought out, he brings down the Arms to make more Room, and then clapping one Hand flat upon the Breast of the Child to support it, he lays the other on the Shoulders, and pulls. If the *Os internum* has contracted round the Neck, he dilates it : If the Head sticks notwithstanding this, he advances the lower Hand, till he can put a Finger or two into the Child's Mouth ; and then pressing on the lower Jaw, he draws with both Hands, and seldom misses to bring the Child away.

Our Author took always Care to put back the umbilical Rope when it falls out before Birth, and to disengage it from the Child's Neck or Body, or to cut it when it is twisted round any of these Parts, to prevent the *Placenta* being pulled away, or the Circulation being stopped in it.

He always separated the *Placenta* with his Fingers, and did not pull it away by the Navel-string, and took care to free the Womb afterwards of clotted Blood and

Mem-

Membranes, which, when left, occasion Pains and Flooding. He is of Opinion no Time should be delayed in doing this after Delivery, because the Womb contracts very fast.

Clysters to provoke too languid Throws, an Opiate to put away false Pains, and to bring on the true Ones, and a cordial Draught after Delivery when the Woman was low, were all the Medicines he used.

Mr. *Chapman* in his *Essay* on the Improvement of Midwifery, *p.* 7. affirms, that he never did observe the lateral Pointing of the Womb, so much insisted on by *Deventer*, but has observed it turned forwards or backwards.

p. 10. He condemns greatly the Use of the Crotchet or Hook in the Delivery of Women, unless when there is an intire Certainty of the Child being dead; which only can be determined by a Concurrence of all the Symptoms mentioned by Authors, and not by one or two of them.

p. 12. He condemns the Make of the *Extractors* he has seen others employ, but does not describe his own, nor his Manner of slipping a Fillet over the Child's Head.

p. 67. The most effectual Remedy in Flooding is, according to him, to cover the Patient's Body with Clothes dipped in
Oxycrate,

Oxycrate, repeating them as they grow warm, and giving cool acid Liquors to drink.

p. 117. After a hard Labour, and where there has been a Necessity of using some Violence, “ the Woman (says Mr. *Chapman*) is to be treated as one bruised by
 “ a Fall. Here, as a Thing of the great-
 “ est Service, I would recommend wrap-
 “ ping of the Body round with a Sheep’s
 “ Skin hastily flead off, and applied as
 “ warm as possible: I have for many Years
 “ past had a happy Experience of this, and
 “ wish I had come sooner to the Know-
 “ ledge of it than I did, as having always
 “ made Use of it with Success.” This Method is recommended by *Guillemeau*.

Dr. Schulze, Professor of Medicine at *Hall*, contradicts the common Opinion concerning the umbilical Vessels, in two Dissertations he published, to be defended by his Scholars. He endeavours to prove in the *First*, That the Navel is not formed by the Ligature which the Midwives make, or by Animals gnawing the Navel-string of their Young with their Teeth, but by Nature; and that the umbilical Vessels separate spontaneously, or with very little Force, from the interior Surface of the Skin, in the same Manner as we see the
 shriveled

shriveled Navel-string fall off from the exterior Surface. After which the umbilical Vessels within a Child's and other young Creature's Body contract and shrivel, their Extremity by which they adhered to the Navel becoming black and pointed, as if they had been burnt, and at last disappear altogether, without leaving any Vestige that can be observed in the Adult; for, says he, what are commonly described and painted, as these Vessels changed into Ligaments, are no other than the Sheaths in which they were formerly contained.

It is easy to see what Conclusion he draws from this Doctrine in his *Second Dissertation*, viz. That it is unnecessary to make any Ligature upon the Navel-string after Birth; but as he judges the Ligature to be innocent, he does not insist upon its being omitted.

In Confirmation of Dr. *Schulze's* Doctrine, Dr. *Eller*, Physician at *Berlin*, relates several Instances of the Navel-strings of Children being left untied after they were cut, without being attended with any Hæmorrhagy, or other bad Consequence. *Commerc. Norimberg.* 1733, *Hebd.* 48. § 2.

Dr. *Trew* of *Norimberg* having carefully examined the State of the umbilical Vessels of Subjects of different Ages, observes that

the shriveling is not peculiar to these Parts, several other Parts being changed in the same Way; he could discover no Mechanism by which a Hæmorrhagy should be prevented without a Ligature, when the umbilical Vessels are cut; and concludes, that seeing there are Examples of Hæmorrhagies from neglecting to tie the Navel-string, it would be very unsafe to forbear the Use of the Ligature. *Ibid. Hebd. 49. § 1. & Hebd. 50. § 1.*

Dr. *Alexander Stewart*, Physician to the Queen of *England*, formerly (*a*) communicated an Observation of a Serjeant of the Horse-guards, whose *Gall-Bladder* was wounded without any other Bowel being much hurt, and whose Symptoms, in the seven Days he lived after being wounded, were, a great Distension of his Belly, without *Ructus* or *Flatus* upwards or downwards, or *Borborygmi*; no Passage by Stool, and very little Urine, notwithstanding Purgatives and Clysters were given him, and that he took what was thought a sufficient Quantity of Drink and liquid Food; neither had he any sound Sleep, but only short Slumbers, though he took Opiates. There was no Sign of Fever, his Pulse continuing

(*a*) *Philosoph. Transact. Numb. 414. § 2.*

tinuing in a natural State till the Day before he died, when it intermitted. The Wound in the Teguments never suppurated well.

After his Death the Guts were found greatly distended, the Gall-Bladder was almost quite empty, and a great Quantity of Bile was lodged in the Cavity of the *Abdomen*.

The Doctor accounted for all these Appearances, from the Defect of Bile within the Intestines, to stimulate them to a due Contraction, whereby they might resist the elastick Air, or might push the Food or Drink into the Lacteals, or might expel their Contents.—The depriving him of a due Recruit of Chyle, occasioned his want of Sleep, diminished the Secretion of Urine, and prevented a Suppuration in the Wound.—The Vessels being emptied by the Excretions that were not compensated by new Chyle, while the more acrid Particles of the Blood were carried off in the Secretion of Bile, without any of them returning to the Blood again; and therefore the Vessels being neither stretched nor irritated, there could be no Fever.—Since there was a constant Waste of this Man's Liquors without any Supply from the Food, the Doctor concludes him to have died famished.

This Account of the Symptoms, however ingenious, did not fully satisfy some People, whose Difficulties our Author now endeavours to remove.

To those Gentlemen who remark, that the Gall (especially in such large Quantity as in the History) when applied to the exterior Surface of the Guts, might have irritated some particular Parts of them to a spasmodic Constriction, which would have occasioned the Distension of the intermediate Parts, and the other Symptoms, as well as the Causes assigned above: The Doctor replies, That Nerves only exert their Action at their Extremities, where they are divested of their involving Membranes; and therefore, in the Case before us, the Bile could not have given Pain, nor excited a Contraction in the muscular Fibres of the Guts. 2. The Irritation of the exterior Membrane of the Guts, would have no Effect on the muscular Coat, because the former has its Nerves from a Source different from those of the latter. 3. The Gall being equally diffused over the Surface of the Guts, must have made an equal Contraction of their Fibres every where, which was not the Case.

In explaining how a fresh Recruit of Chyle should be a Cause of Sleep, Dr.

Stewart

Stewart is obliged to examine how and by what Sleep is produced.

“ I believe (says he) it will hardly be
 “ denied, that the Cause of Sleep in gene-
 “ ral is a Want of a sufficient Quantity of
 “ animal Spirits [for the Existence of which
 he appeals to the Arguments and Experi-
 ments mentioned *p.* 387 of *Vol.* II.] “ for
 “ the Use and Exercise of the animal Fun-
 “ ctions; therefore whatever prevents their
 “ Recruit, hinders or impedes their Secre-
 “ tion; absorbs or fetters them when pro-
 “ duced; and whatever exhausts and eva-
 “ porates them, by occasioning a Paucity
 “ of Spirits, will, in a healthy Person, pro-
 “ duce a Listlessness, Laziness, a Tenden-
 “ cy to sleep, or Sleep itself, in Propor-
 “ tion to that Paucity of the remaining
 “ Spirits.” To illustrate this Doctrine,
 he considers the remoter Causes of Sleep,
 which he reduces to four. 1. Exercise.
 2. A too plentiful Meal. 3. Drunkenness.
 4. Narcoticks. And then proceeds to shew
 how these produce such Effects.

Exercise wastes all the Fluids, and particularly the animal Spirits.—The great Quantity of Chyle after a full Meal makes all the Fluids of a thicker Consistence, and absorbs the animal Spirits.—*Fermented Liquors* and ardent Spirits being observed

to diminish remarkably the serous Secretions, may therefore be reasonably concluded to fetter the finest Fluid, which is the animal Spirits, and to hinder it to be separated from the other Liquors.—*Soporificks* act much in the same Manner.

According to our Author, In Sleep a sufficient Quantity of Spirits still remains for actuating the Organs of the vital and natural Functions, to which they are determined by more powerful Causes, such is the impetuous Blood in the Heart, gravitating Air in the Lungs, digesting Food in the Stomach, &c. than there are to determine them to the Organs of the animal Functions. Hence Awaking is owing to a Quantity of Spirits so much greater than what is required for the vital and natural Functions, that they must excite the animal likewise.

The last Proposition which the Doctor undertakes to prove is, “ That *Pus*, being a gross Secretion, is the Product of the Chyle, and not of the Blood or Serum; for (says he) I think it would not be difficult to prove that all the gross Secretions are from the Chyle.” *Philos. Trans. Numb. 427. § 2.*

Mr. *Evan Davis* communicates to the *Royal Society* the Histories of several Children

dren inoculated with the Small Pox at *Haverford-West* in *Pembroke-shire*, while the Measles were epidemick there in *February* and *March*, after the Small Pox had been very mortal through the Winter. Every one of them who were infected thus with the variolous Matter, only became feverish in the seventh or eighth Day after the Inoculation, and the Measles appeared soon after. On the twelfth Day they were again attacked with a Fever, and on the fourteenth the Small Pox of a mild kind were seen. *Ibid. Numb. 429. § 9.*

Dr. *Lobb* in his rational Method of curing Fevers, after having examined the Nature of the Fluids and Solids of the human Body, Things necessary to Health, (such as, the Air, Aliments, Secretions, and Evacuations,) the Causes of Diseases, and particularly of Fevers, concludes, *p. 194*, That whatever may be the productive Causes of Fevers, the State of the Fluids in People under them, must be one or other of these following;

1. That the animal Fluids are *too thick*, that is, they are viscous or glutinous, which seems to be the Case in all inflammatory Fevers. Or,

2. That they have Particles *too bulky* for

an easy Circulation and Excretion, till they are comminuted. Or,

3. That the animal Fluids are *too thin*, and the natural Union of their component Particles is more or less dissolved, and the Globules of the Blood and Lymph more or less broken. Which appears to be the Case in putrid, malignant and many pestilential Fevers, and in all Fevers attended with colliquative Evacuations. Or,

4. That the Fluids have acrimonious and corroding Particles mixed with them, which is the Case in all Fevers attended with Ulcerations from an internal Cause.

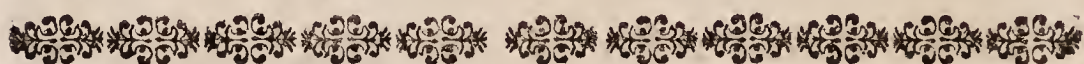
While the Fluids are thus affected, the Solids are *rigid* or *too dry*; or they are *too lax*.

It is impossible for us to mention, in the narrow Bounds we are confined to, all our Author's curative Indications taken from the foregoing Doctrine; we shall therefore do no more than remark, that he allows of Blood-letting only to Patients who have a sanguine Plethora, for the Knowledge of which he refers to his Treatise of the Small-Pox, where, as we mentioned in *Vol. I. p. 348*, he confines it to so many Circumstances, that it will seldom be met with; and in those Patients to whom letting of Blood is proper, “the Quantity of Blood
“ (says

“ (says he, *p.* 208.) that may prudent-
“ ly be taken away at once, I think gene-
“ rally speaking, should not exceed six or
“ eight Ounces; because we cannot know
“ to an Ounce or two the exceeding Quan-
“ tity, and because, if it should afterwards
“ appear that too little has been taken a-
“ way, the Remedy is easy, by repeating
“ Phlebotomy; but if too much has been
“ drawn off, it is not easy to redress the
“ Inconveniencies that may attend it.”

Afterwards in considering the Effects of
Blooding, Dr. *Lobb* deduces from Mr.
Hales's Experiments, that taking away six
Ounces and two Drachms of Blood from a
Man weighing 160 *lib.* may diminish the
vital Strength, or the Force of the Action
of the Heart and Arteries about one tenth
Part. The Loss of twelve Ounces and a
half of Blood will diminish his vital Strength
above one sixth Part, which, says he, is a
great Diminution. Eighteen Ounces and
six Drachms will diminish it above one
fourth, which, he adds, is a vast Diminu-
tion, and to be avoided, unless some ex-
treme Necessity should require the taking
of it. Thirty seven Ounces and a half
of Blood taken away, diminish the vital
Strength of such a Man near one half,
a Diminution which surely ought to be
dreaded.

dreaded. Fifty Ounces may diminish it near six sevenths; the Consequences of which may, says our Author, be easily apprehended. From the whole we think it may be concluded, that the Doctor is not very fond of taking Blood, especially in a large Quantity.



XXXII. *A List of Medical Books published since the Beginning of the Year 1733.*

A *Lbum Bavariæ Patræ, seu catalogus celebriorum aliquot Medicorum, qui suis in Bavaria scriptis medicinam exornarunt, ab anno 1450, quo Boica schola fundata quidem, at primum anno 1472 publicata fuit, in hodiernam usque lucem. Studio Franc. Jos. Grienwaldt, M. D. 8vo, Monachii 1733.*

The Treasury of Drugs unlocked; by *Jo. Jacob Berlu*, of London Merchant in Drugs. The second Edition, 12mo, London 1733.

A Treatise on the Force and Energy of crude Mercury, by *Thomas Harris*, Surgeon, 8vo, London 1734.

A critical Dissertation on the Manner of
the

the Preparation of Mercurial Medicines, by T. K. M. D. 8vo London 1734.

Hamstead-Wells; or Directions for the drinking those Waters; with an Appendix relating to the Original of Springs in general; with some Experiments on the *Hampstead Waters*, and Histories of the Cures, by John Soame, M. D. 8vo, London 1734.

An Enquiry into the Contents, Virtues and Uses of the *Scarborough Spaw Waters*, by Peter Shaw M. D. 8vo, London 1734.

An Enquiry into the Nature and Principles of the *Spaw Waters*, by Charles Perry, M. D. London 1734.

Toxicologia pathologico-medica, sive de Venenis, Lib. III. Autore Christiano Godofr. Stentzelio, M. D. 4to, Vitemberg. 1733.

Chemical Lectures publickly read at London, in the Years 1731 and 1732, and since at Scarborough in 1733, for the Improvement of Arts, Trades, and natural Philosophy, by Peter Shaw Physician at Scarborough, 8vo, London 1734.

Traité de Chemie, contenant la maniere de preparer les remedes qui sont le plus en usage dans la pratique de la Medecine. Par M. Maluin Docteur Regent de la Faculté de Medecine de Paris, 12mo, Paris 1734.

Oste-

Osteographia; or, the Anatomy of the Bones, by *William Cheselden* Surgeon to her Majesty, &c. *Fol. London 1733.*

The Anatomy of the human Bones, with an Account of muscular Motion, and the Circulation of the Blood; also of Digestion and Nutrition, with a Description of the four Senses illustrated with Variety of Copper-plates. To which is added, a short and easy Method of discovering the Virtues of Plants, in curing the Diseases of the human Body; by *George Thomson*, M. A. 8vo, *London 1734.*

Spiramina, or Respiration reviewed; being chiefly the Argument of that great Philosopher by Fire, *Jo. Bapt. van Helmont*; discovering certain Uses of the Lungs not commonly observed, and asserting that they have not that alternate Motion that is generally ascribed to them; but that in a sound Man they are porous, pervious to the Air, and constantly at rest, by *M. J.* 8vo, *London, 1733.*

Compendium Anatomicum, ea omnia complectens quæ ad cognitam humani corporis æconomiam spectant, &c. constructum à F. Nichols è Coll. Oxon. M. D. Præf. Anat. Oxon, &c. 4to, Londini 1733.

Physical Essays on the Parts of the human
man

man Body, and animal Oeconomy, 8vo, London 1734.

Anatomie chirurgicale de Palfyn, revue, corrigée & augmentée, accompagnée de Notes dans le premier Volume, & re-fondue dans le second, par M. B. Boudon, Docteur en Medicine. On y a joint les Observations anatomiques & chirurgicales de Mr. Ruysch traduites du Latin & celles de M. Brisseau, en 2 Vol. 8vo, Paris 1734.

The Navy Surgeon; or a practical System of Surgery, by John Atkins Surgeon, 12mo, London 1734.

Two hundred and twenty five Cases in Midwifery, which for the most Part were attended with a great deal of Danger and Difficulty. Written by the late Mr. William Giffard, Surgeon and Man-Midwife published by Edward Hody, M. D. 8vo, London 1733.

The Art of Nursing, the second Edition, 8vo, London 1733.

An Essay concerning Blood-letting, by R. Butler, M. D. 8vo, London 1734.

Suite des maladies chroniques ou l'on traite celles qui arrivent à l'Oeil, & des remedes les plus convenables pour les guerir sans operation manuelle par P. V. Dubois ancien Prevôt & Garde des Maitres Chirurgiens de Paris, Tom. V. 12mo, Paris 1733.

Non-

Nouvelles classes des maladies dans un ordre semblable à celui des Botanistes, comprenant les gendres, & les especes de toutes les maladies, avec leurs signes & leurs indications; par Sauvage de la Croix, Docteur en Medicine, 12mo, à Avignon 1733.

A complete Treatise of the Stone and Gravel, by N. Robinson, M. D. the third Edition, 8vo London 1734.

Meditationes theoretico-practicæ de furore hæmorrhoidum internarum methodicè conscriptæ à Justo Arnaldo Gulich, M. D. Editio altera, 8vo, Lugd. Bat. 1733.

An Essay on the Gout, by T. Bennet, M. D. 8vo, London 1734.

Rational Methods of curing Fevers, deduced from the Structure and Oeconomy of human Bodies, and the different States of the Solids and Fluids, under the different Classes of Fevers; by Theophilus Lobb, M. D. 8vo, London 1734.

The generous Phyfician, or Medicine made easy; by Dr. Colbatch, 8vo, London 1733.

Frederici Hoffmanni consultationum & responsorum medicinalium centuria prima, complectens morbos capitis & pectoris, Tom. I. 4to, Halæ Magdeburg. 1734.

Michaelis Alberti, Acad. Frid. Prof. Med.

*Med. &c. ulterior continuatio, aut Tomus
3^{tius}, jurisprudentiæ medicæ, 4^{to}, Schne-
berg. 1733.*

*Caroli Musitani Jatrias Prof. opera
omnia. Edit. 2^{da}, 2. Vol. Fol. Lugdun.
1733.*

• The Philosophical Transactions (from the
Year 1720, to the Year 1732) abridged
and disposed under general Heads, by Mr.
Reid and *John Gray*, F. R. S. 2 Vol. 4^{to},
London 1733.

The Philosophical Transactions (from the
Year 1719, to the Year 1733) abridged and
disposed under general Heads, by Mr. *John
Eames* and Mr. *John Martyn*, F. R. S.
2 Vol. 4^{to}, London 1734.

*Acta Physico-medica Academiæ Cæsareæ
Leopoldino-Carolinæ naturæ curiosorum,
exhibentia ephemerides sive observationes,
historias, & experimenta à celeberrimis
Germaniæ & exterarum regionum viris
habita & communicata, singulari studio
collecta. Volumen tertium, 4^{to}, Norim-
berg. 1733.*

Philosophical Transactions for the Year
1733, 4^{to}, London.

*Commercium literarium Norimbergense
anni 1733. Semestr. 2. 4^{to}, Norimberg.*

*Dissertationes medicæ, quas ex auctori-
tate amplissimi Senatûs Academici Edin-
bur.*

burgensis, & nobilissimæ in eadem Academia Facultatis medicæ Decreto, pro gradu Doctoratûs summisque in Medicina honoribus & privilegiis ritè ac legitimè consequendis, examini subjecerunt.

Joannes Lindefay Scotus, *De calore.*

Jacobus Grieve Scoto-Britannus, *De morbis humorum oculi.*

Carolus Aytoun-Douglas Scoto-Brit. *De Exercitationum in Medicina usu.*

Joannes Arnot Scotus, *De abortu.*

Henricus Tonge Anglus, *De noxis ex cibi & potionis abusu oriundis.*



XXXIII. Books proposed, and other Medical News.

DR. Boerhaave, Professor of Medicine at Leyden, concludes the Account of his Experiments on Mercury, with a Promise, conditional indeed, but which probably the importunate Requests of the Learned will obtain, of publishing his Experiments and Remarks concerning the Extraction of Mercury out of Metals, the Action of Mercury on Metals, and concerning Metals.

The new Edition of the *Edinburgh Dispensary*.

pensatory is now delivered to the Printers, and will speedily be published.

Doctor *Christ. Jac. Trew* of *Norimberg* has dispersed Proposals for publishing a full, faithful and distinct Delineation and Explication of all the Parts of the human Body. He does not propose to publish this whole Work at once, but divided into Sections. The *Osteology* seems to be ready for the Press; for the Proposals inform us, That the Bones of a young Man are delineated in twelve Tables in *Folio*; the thirteenth Plate represents the Bones of the Female which differ from the Male. The Conjunctions of the Bones are to be explained in a Plate larger than the others. The Explication of these Plates in *High Dutch*, will be twelve Sheet; and he promises this shall be translated into *Latin* or *French*, and printed, if any desire it.

Dr. *Thomas Simson*, Professor of Medicine in the University of *St. Andrews* designs to publish soon a second Edition of his *System of the Womb*. The theoretical Part of which he is to enlarge considerably, and is to add a practical Part, wherein he is to treat of the Diseases of the Womb, and their Cure.

Dr. *Lobb* tells us in his rational Methods of curing Fevers, That he has a Treatise

on the particular Species of Fevers near ready for the Press, which he designs to publish soon, that he may complete his Account of Fevers.

Dr. *Michelotti* Physician at *Venice* has promised soon a Treatise on the Small-pox.

Dr. *Grubert* Physician at *Brussels* is said to be about to publish a Medical Dictionary, in which there are to be several Discoveries.

The Subject proposed by the Chirurgical Academy at *Paris*, for gaining the Prize of 1734, is, *To determine in each kind of chirurgical Disease, the Cases where it is fit to dress frequently, and those where it is fit to dress seldom.*



I N D E X.

A

- A** NALOGY, the surest Method of discovering the Principles of Mineral Waters, *Page* 75.
- Anastomosis between the uterine and placental Vessels denied, 269.
- Anatomical Preparations, the Method of making and preserving them, 107.
- Angina, the History of an uncommon one, 342.
- Animal Heat, an Essay on it, 133.
- Ankle, an Ulcer of it, at which the *Menstrua* were regularly evacuated, 381.
- Antimony Crude, cures Palsies, Pains and Numbness, 389. Its Sulphur, Disputes concerning the Effects of it, 390. Its Butter esteem'd an universal Medicine, 391.
- Ascites Hydrops, the Water of one evacuated at the Navel, 378.
- Asthma, the History of one with uncommon Symptoms, 349.

B

- B** Arry (Dr. Edward) his Account of a malignant *Lues Venerea* communicated by Suction, 325.
- Bath, a warm one, the Use of it in a bilious Colick, 358.
- Berkeley (Dean) his Opinion concerning Vision refuted, 231.
- Blood, a new Opinion concerning its Circulation, 395.
- Boeli (Dr.) recommends the Root of *Valerian* in weak Sight, 391.
- Boerhaave (Dr.) his Experiments on Mercury, 386.

Books medical published in 1732, 384. since the Beginning of 1733, 414. proposed to be soon published, 420.
 Burials, an Extract of them from the Register in *Edinburgh*, 31.
Butter (Mr. *Alex.*) his Description of a new Forceps for extracting Children, 322.

C

C *Alder* (Mr. *James*) his Observation of the *Menstrua* evacuated at an Ulcer of the Ankle, 381.
 Cataract, what it is, 399.
 Chalybeat Waters, Remarks on them, 47, 393.
Chapman (Mr.) his Improvements in Midwifery, 403.
 Circulation of the Blood, a new Doctrine concerning it, 395.
 Colick bilious, the Use of the warm Bath in it, 358.
 Colours, how considered as the Objects of Sight, 215.
Conessi Bark, its Effects in Diarrhœæ, 32.
Cortex Peruvianus, Histories of its curing Mortifications, 35, 43.

D

D *Avis* (Mr.) his Observations of the Inoculation of the Small-Pox, 410.
 Diarrhœæ, the *Conessi* Bark a good Cure for them, 32.
 Digastric Muscles their Situation and Uses, 263.
 Discoveries and Improvements in Physick published in 1732, 382. since the Beginning of 1733, 386.
 Diseases most frequent last Year in *Edinburgh*, 26.
 Distances of Objects known by the Angle of the Rays of Light, 187.
 Dropsy, the Water of one evacuated at the Navel, 378.
 Duct salivary, when wounded, cured by a Perforation into the Mouth, 277.

E

E *Dinburgh*, Diseases most frequent last Year in it, 26. Burials there, 31.
Eller (Dr.) his Observations of the Navel-strings needing no Ligature, 405.

Extractor, a new one for Children in the Birth, 322.
Eyes, an Essay on their Motions, 160.

F

F Evers, a rational Method of curing them, 411.
Fistula lachrymalis, an Essay on it, 280.
Forceps, a new one for extracting Children, 322.

G

G Angrenes stopt by the *Cort. Peruv.* 35, 43.
Genital Organs preternaturally form'd, 278.
Giffard (Mr.) his Improvements in Midwifery, 400.
Goolden (Mr. Samuel) his History of a Gangrene stopt by the
Peruvian Bark, 35.

H

H Eat animal, an Essay on it, 133.
Henbane, the Effects of its Seeds, 392.
Hydrocephalon, Histories of it, 334, 335.
Hydrops Ascites, the Water of one evacuated at the Navel, 378.

I

J Amieson (Mr. James) his Observation of a large Steatom in
the Thorax and Abdomen, 354.
Improvements in Physick published in 1732, 382. since the
Beginning of 1733, 386.

K

K Ermes Mineral, a famous Medicine in France, 390.
Kulm (Dr.) his Improvements in Anatomy, 382.

L

- L** Achrrimal Canals, an Essay on their Diseases, 280.
Lobb (Dr.) his Method of curing Fevers, 411.
Lues Venerea, a malignant one communicated by Suction, 325.
 A new and effectual Method of treating it, 330.

M

- M** *Artine* (Dr, George) his Essay on animal Heat, 133.
 Medical Books published in 1732, 384. Improvements and Discoveries in 1732, 382. since the Beginning of 1733, 386. News, 420.
Menstrua regularly evacuated at an Ulcer of the Ankle, 381.
 Mercury, its different Operation in different Constitutions, 329. Experiments concerning it, 386. given in various Forms, 388.
 Midwifery, Improvements in it, 400.
 Mineral Waters, Difficulties in enquiring into their Principles, 61. Analogy the surest Method of discovering them, 75. the History of several, 392.
Monro (*Alexander*) his Remarks on Steel Waters, 47. Essay on the Method of preparing and preserving the Parts of Animals for anatomical Uses, 107. Supplements to *Art* 9. Vol. I. and *Art*. 9 & 13. Vol. II. 263. Essay on the Diseases of the lachrimal Canals, 280. his Observation of a *Procidentia uteri*, 305. of an uncommon *Angina*, 342. of an *Asthma* with uncommon Symptoms, 349.
Montrose Water, an Enquiry into its mineral Principles, 60. its medical Qualities, 96.
 Mortifications cured by the *Peruvian* Bark, 35, 43.
 Motions of the Eyes, an Essay on them, 160. why uniform, 183.
Mowat (Mr. *James*) his Description of the genital Organs preternaturally formed, 278. Observation of a *Hydrocephalum*, 334.
 Muscles digastric, their Situation and Uses, 263. Of the Eyes, their Description and Uses, 164. the Want of them how supplied, 178. Observations on those of the human Body, 395.

Nails,

N

- N** Ails, whence they rise, 383.
 News medical, 420.
Nichols (Dr.) his Opinion of the Circulation of the Blood, 395.
 Nose, a Tumor of it unsuccessfully extirpated, 301.

O

- O** bjects of Sight, their Distance known by the Angles of the Rays of Light, 187. Opinions concerning their being seen single with two Eyes refuted, 192. The real Cause of this Phenomenon, 235. All the Points of them seen in straight Lines perpendicular to the *Retina*, 208. Why seen erect, 213.
 Organs of Generation preternaturally formed, 278.
Os Uteri, its Sides grown together, 317.

P

- P** *Aisley* (Mr. John) his History of a Mortification cured by the *Peruvian Bark*, 43. Of a *Hydrocephalon*, 335.
Peruvian Bark, Histories of its curing Mortifications, 35, 43.
Pessary, a new one described, 313.
Placenta, its Vessels do not anastomose with the Uterine, 269.
Porter (Dr. Robert) his Essay of the Service of a warm Bath in a bilious Colick, 358.
Porterfield (Dr. William) his Essay on the Motions of the Eyes, 160.
Pozzi (Dr.) his Improvements in Anatomy, 383.
 Preparations, the Method of making anatomical ones, 108.
 Preserving, the Method of it in anatomical Preparations, 127.
Pringle (Dr. Francis) his Observation of the Water of a Dropsy evacuated at the Navel, 378.
Procidentia Uteri, an Account of one, 305.

R

- R** egister Meteorological, 1. Of Burials in *Edinburgh*, 31.

Salivary

To the Bookbinder.

	Tab.		Pag.
Place	I.	Fronting	262
	II.		280
	III.		300
	IV.		312
	V.		324

